

# MARINE CORPS WARFIGHTING LABORATORY

15 June 2001

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***EXPERIMENTATION CAMPAIGN PLAN: 2001***




UNITED STATES MARINE CORPS  
MARINE CORPS WARFIGHTING LABORATORY  
MARINE CORPS COMBAT DEVELOPMENT COMMAND  
QUANTICO, VIRGINIA 22134-5096

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Plans ECP  
15 JUNE 01

From: Commanding General  
To: Distribution List

Subj: Marine Corps Warfighting Laboratory Experimentation Campaign Plan -- 2001

1. This document provides a conceptual framework for Marine Corps experimentation supported by the Marine Corps Warfighting Laboratory. It is intended as a guide to the range of both Service and Marine Corps in support of Joint experimentation initiatives currently underway with Lab support. In this regard, it is formatted to permit rapid modification of individual sections and initiatives with currency indicated by dates in the upper right hand corner of each page.
2. The Campaign Plan is organized into individual sections to permit ready reference to specific areas of interest:
  - Section I provides a general description of the Lab's mission, innovation and experimentation process, and anticipated experimentation schedule through June 2002.
  - Section II discusses each of the major Service experimentation areas of effort. These areas of effort are intended to focus Service experimentation in support of the Marine Corps Title X responsibilities to organize, train and equip Marine Corps expeditionary forces. The central theme for Service experimentation is at the tactical level, in support of the Marines *in the last 300 yards* where they are actually in contact with the enemy.
  - Section III focuses on the Lab's support of Commander, Marine Forces Atlantic for Joint experimentation, *Millennium Challenge 02*, and outlines the Joint Experimentation framework through 2008.
  - Section IV contains a compendium of Lab experimentation initiatives -- grouped by Service Advocate -- that describes the experimentation goals and milestones for Lab supported experimentation initiatives to be completed by June 2002.
3. My intent is to publish a revised Campaign Plan annually. However, in view of the pace of change within experimentation, recommendations for changes to this Campaign Plan are solicited at anytime. Forward comments and recommendations to the Commanding General, Marine Corps Warfighting Laboratory (Attn: Plans Division).

  
William D. CATTO  
Brigadier General, USMC

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Lists A&B and All Hands of MCWL

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## OVERVIEW

### Why a Marine Corps Warfighting

**Laboratory.** In October 1995, General Charles C. Krulak chartered the Commandant's Warfighting Laboratory as the engine for change and the center of innovation within the Marine Corps as it entered the 21<sup>st</sup> Century.

Within 18 months, the Lab had developed a means for looking at change – called the *Sea Dragon Process* – and completed several of its initial assigned tasks as stated in the Commandant's Planning Guidance.

The Lab developed a concept for the Chemical and Biological Incident Response Force and then oversaw implementation of both a Marine operational force established in Norfolk and a reachback capability resident in a group of nationally recognized experts – led by Nobel laureate Dr. Josh Lederberg -- for scientific expertise. It also planned and conducted a Limited Objective Experiment with Non-Lethal Weapons conducted at Camp Pendleton, CA.

In addition, the Lab developed a five-year experimentation plan – the Warrior Experimentation Series – and executed *Hunter Warrior* as an initial major Advanced Warfighting Experiment involving West Coast Navy and Marine operational forces.

In 1997, in recognition that innovation within the Marine Corps must be an integral part of the Combat Development System (CDS), the Lab was renamed as the Marine Corps Warfighting Laboratory.

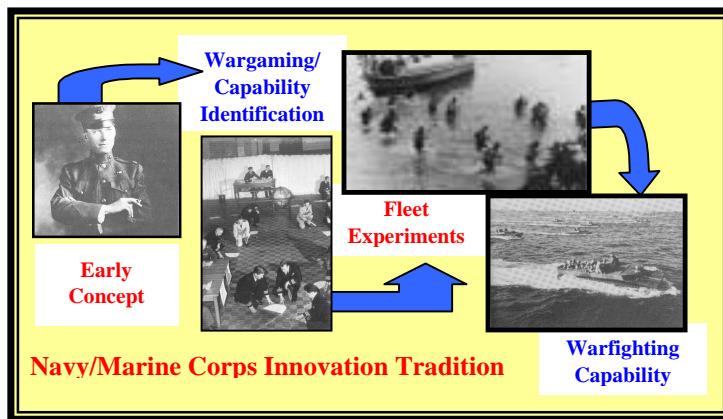
In 1998, the Commanding General of the Lab was assigned the additional responsibility as Vice Chief of Naval Research and assumed a major role in oversight of Marine Corps-related Naval Science and Technology programs.

**Mission.** The mission of the Marine Corps Warfighting Laboratory is as follows:

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*To conduct concept-based experimentation for the identification, development, and integration of operational concepts with tactics, techniques, procedures, and technologies in order to improve the naval expeditionary warfighting capabilities across the spectrum of conflict for current and future operating forces.*

Experimentation is conducted both to meet Service Title X responsibilities and as a Marine Corps contribution to Joint concept development and experimentation. Service experimentation is conducted in support of the Warfighting Advocates – Command Element, Ground Combat Element, Air Combat Element, and Combat Service Support Element – with the results supporting the Marine Corps CDS. Joint experimentation is supported through Marine Forces Atlantic as the assigned lead for Marine Corps participation in Joint Forces Command's joint experimentation program.



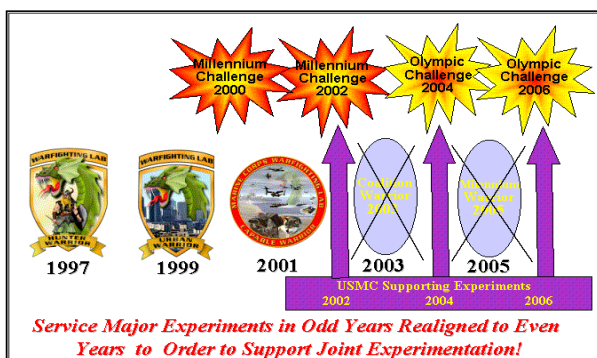
The Lab conducts experimentation using a concept-based innovation and experimentation model. The model begins with an idea – a concept – and proceeds through a capabilities refinement phase usually associated with wargaming, an experimentation phase, and a capability development phase within the CDS.

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## EXPERIMENTATION PHASES

During the first six years, the Lab focused its experimentation efforts in supporting the *Warrior Series* of experiments. Each phase was intended to last approximately two years in length, culminating in an Advanced Warfighting Experiment (AWE). Each phase was given a title – *Hunter Warrior*, *Urban Warrior*, and *Capable Warrior* – reflecting the conceptual focus of the phase of the experimentation.



Initially, the Warrior Series was an effective means to focus Marine Corps experimentation efforts. However, with reorganization of the CDS to be more responsive to the Warfighting Advocates and the increasing emphasis on Joint experimentation, the Warrior Series no longer is an effective means to organize Marine Corps experimentation.

Accordingly, the *Capable Warrior* AWE scheduled for May 2001 along with the Extending the Littoral Battlespace, Advanced Concept Technology Demonstration (ELB ACTD) second Major Systems Demonstration has been significantly downsized and subsequent warrior phases cancelled. Instead of major Warrior Series AWEs on odd numbered years, the Lab will shift to supporting major Joint experiments on even numbered years.

## Areas of Efforts

The Lab has divided its efforts into Focus Areas and Supporting Areas of Effort in order to focus experimentation in areas of effort that reflect both Service-specific and Marine Corps contributions to future Joint warfighting capabilities,

### Focus Areas

- Command and Control/Information Technology (C2IT)
- Reconnaissance, Surveillance, and Target Acquisition (RSTA)
- Asymmetric Threat
- Military Operations in Urban Terrain (MOUT)

### Supporting Areas of Effort

- Fires and Maneuver
- Logistics
- Wargaming

Each of the Area of Effort are addressed in detail within Section II.

## Experimentation Philosophy

The Lab focuses its Service experimentation at the tactical level. It is oriented around the Marine infantryman although its contribution is always assumed to occur in a joint context.

In the future, most Marine Corps experimentation at the operational level of war will be conducted within – or in support of – Joint experimentation. Joint experimentation at the operational level will likely integrate simulation with live-force experimentation to adequately assess future concepts and capabilities.

## THE INNOVATION AND EXPERIMENTATION (I&E) PROCESS

### Purpose of the Process

The I&E Process describes the procedures for experimentation development from beginning to end. Each experiment is different. The I&E Process organizes experimentation into manageable and logical steps. It provides a schematic appreciation of the steps required to formulate an experiment through transition of the results into the Combat Development System (CDS).

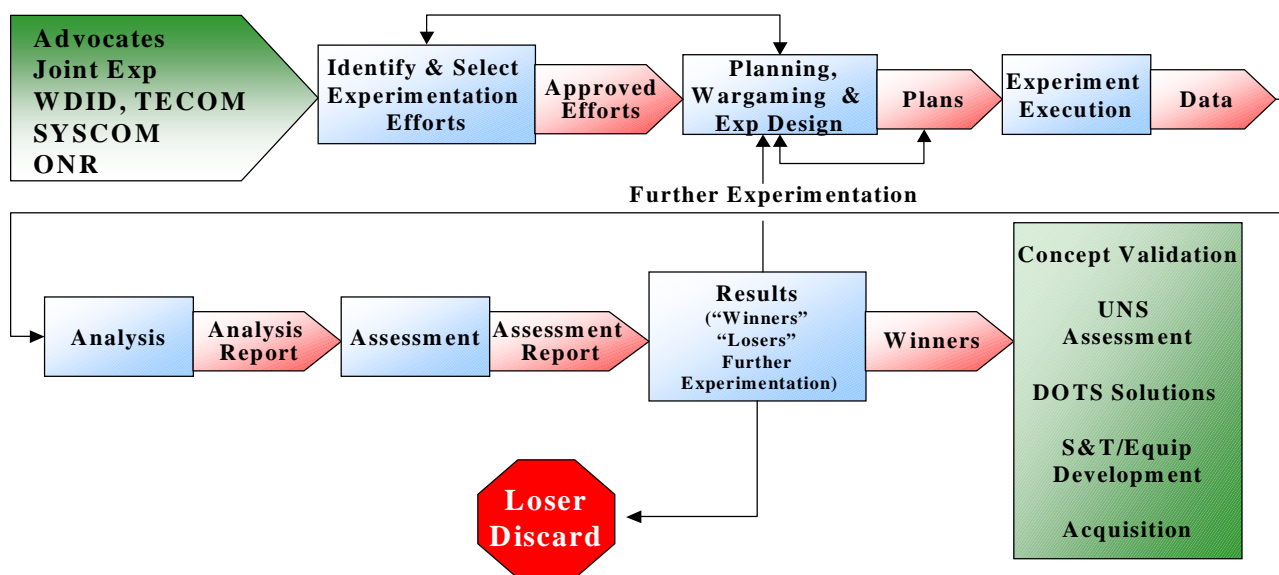
The colors in this schematic are significant. The **Green Blocks** represent the customer within the CDS such as the staff within the CDS represented by Warfighting Development Integration Division (WDID), Training and

Education Command (TECOM), and Marine Corps Systems Command (SYSCOM). The Office of Naval Research (ONR) is likewise a major client. The **Blue Blocks** represent staff functions that are accomplished within the Lab. The **Pink Blocks** represent decisions or specific products.

Not all experimentation products are pre-acquisition equipment solutions. As indicated in the last **Green Block**, experimentation can validate a concept, or define a need expressed in a Universal Need Statement (UNS) or define changes in doctrine, organization, training, and support (DOTS).

Experiments sometime show that a concept does not work. This is not failure. Sometimes the ability to declare a concept as a *loser* can result in significant savings in time and resources that can then be reallocated to those that are identified as *winners*.

## MCWL Experimentation Process



## WHY EXPERIMENT?

The Lab conducts military experiments to assess whether or not a new concept will demonstrate an increase in desired combat capability. However, not every *good idea* warrants an experiment. Before the Lab spends the resources to conduct the experiment, there must be an expectation that the results will be of value to a future warfighting capability.

The Lab cannot afford to experiment simply to learn. There must be some reasonably expectation that *what* is learned will help the Marine Corps decide – from a warfighting perspective – what to buy, how to organize, how to train, or what tactics, techniques and procedures (TTPs) the Operating Forces will use in the future.

In most cases experiments are performed in partnership with an Advocate or an agency within the Combat Development System intended to lead directly into an implementable recommendation.

### Experiment Defined:

1. a. *A test under controlled conditions that is made to demonstrate a known truth, examine the validity of a hypothesis, or determine the efficacy of something previously untried.*

b. *The process of conducting such a test; experimentation.*

2. *An innovative act or procedure.*

3. *The result of experimentation.*

Source: The American Heritage Dictionary, Third Edition: Houghton Mifflin Company

At the same time, all experimentation must follow recognizable guidelines that lead to some assurance that it is verifiable and based on the scientific method.

**Where Do Experiments Come From?** The seed of an experiment can be a concept developed either in response to a warfighting deficiency identified by the Operating Forces or within the Combat Development System. It could also originate from ideas for new capabilities identified by Lab members as a result of wargaming, coordination with industry, or with outside agencies. Sometimes special Department of Defense or Congressional interests can drive an experiment.

## Types of Experiments

The Lab performs the following three types of experiments:

*Limited Technical Assessment (LTA).*

Focused on the technical performance of a particular technology.

- *Limited Objective Experiment (LOE).*

Focused on the utility of experimental TTPs in a tactical scenario. Alternatively, the focus could be on the utility of new equipment or experimental technology in the context of a tactical scenario, with or without experimental TTPs.

- *Advanced Warfighting Experiment (AWE)*

A larger scale LOE, that usually involves multiple combinations of experimental: technologies and TTPs.

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**When is an LTA Appropriate?** An LTA is appropriate if actual hardware/software is available to be tested. When this is the case, the intent is to try to learn how a technology performs relative to experimental objectives or to verify claims made by the manufacturer. Sometimes the intent is to compare the performance of several technologies that perform the same function. The guiding principles of an LTA are:

- Unless a surrogate is to be used in its place, any technology that is part of an AWE or LOE should first undergo an LTA to verify its performance. (More about surrogates later.)
- An LTA does not necessarily need to take place in the context of a tactical scenario.

**LTA is Methodical and Repetitious.** In order to be effective, an LTA must be a methodical test of specific capabilities of a technology with numerous iterations of each capability. From a scientific standpoint, LTAs tend to be more mathematically intensive than LOEs because they often look at a single measurement under several sets of conditions and can achieve larger sample sizes than LOEs. For example, if the Lab were interested in an experimental rifle, it would want to test it as follows:

- Fire at various ranges measuring accuracy and lethality of rounds.
- Measure how long it takes a representative cross-section of Marines to clean it.
- Have Marines of various body types execute a predetermined set of tasks while carrying it and measure performances against task standards.
- Collect data on material failures and measure time and equipment required to repair.

These are events that might happen over the course of a free play scenario; however, none can be assured to occur. Therefore, an LTA is typically conducted without a tactical scenario by having Marines execute a list of specific tasks focused specifically on the measurement objectives.

### **Progression from LTA to LOE and AWE.**

When an LTA indicates that the performance of a particular technology has potential to enhance combat capability, the Technology Division will propose to experiment with it in LOE or AWE. Although the subsequent LOE or AWE is *about* the new technology, it has an expanded focus on the impact of the technology on the tactical performance of the operational unit rather than the performance of the individual technology.

**Operational Integration Underpins LOEs and AWEs.** In contrast to an LTA, an LOE or AWE has to be driven by operational considerations in order to be useful. In these experiments, there is generally an underlying scenario in which Marines use a new capability. The experiment participants must be allowed to act according to tactical conditions to complete their mission, rather than being forced to execute a fixed set of tasks that may or may not relate to the mission.

### **When is the LOE or AWE Appropriate?**

If the goal is to experiment with a new TTP, or if the intent is to learn about the value of a technology with a performance that has already been verified, an LOE or AWE is the proper venue. AWEs and LOEs examine whether some change to the current way of operating will help Marines better perform their tactical tasks. Because both generally take place in the context of a tactical scenario, LOEs and AWEs use operational forces.

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### Differences Between the LOE and AWE.

The key difference between the LOE and the AWE is the scope of the effort:

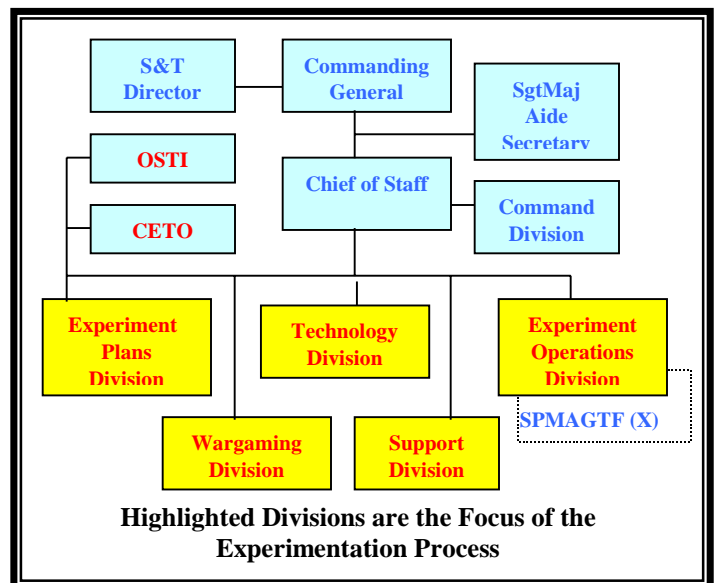
- An LOE generally focuses on a single hypothesis in a limited context where only select characteristics of the tactical environment are emulated. Some LOEs may involve only a small group of personnel in vehicles simulating an entire battalion.
- An LOE may not be a single discrete event especially when assessing new TTPs.
- An LOE may involve weeks of training and iterative tactical experimentation rather than simply a single experimentation event.
- An AWE is usually a larger-scale evolution assessing several hypotheses during the same event. An AWE almost always involves the employment of a sizable contingent of operational forces.
- An AWE will expand the context to simulate the tactical environment to the greatest extent possible. Whereas an LOE may focus on only one part of a MAGTF – such as an infantry company or a battalion from the Ground Combat Element (GCE) – an AWE is typically conducted at a MAGTF level within a Joint context.

### ORGANIZATION TO SUPPORT THE EXPERIMENTATION PROCESS

The Lab has been organized to support its innovation and experimentation mission. Five of its six functional divisions are designed to support this process. The Experiment Plans Division determines the concept or ideas for change, the Wargaming Division refines the concept and provides capability insights, the Technology Division identifies equipment and technology candidates for experimentation, the

Experiment Operations Division conducts<sup>16 July 2001</sup> detailed planning and executes experiments, and the Support Division assists both in planning and execution.

The Operations Division is dual assigned as a Special Purpose Marine Air-Ground Task Force (Experimental) – SPMAGTF(X)-- command element capable of assuming command of operational forces during experimentation.



The rest of the Lab indirectly supports the experimentation process while performing other assigned functions.

**The Center for Emerging Threats and Opportunities (CETO).** The CETO is a Congressionally mandated organization conducted in partnership between the Lab and the Potomac Institute for Policy Studies. It is chartered to identify emerging non-traditional threats, explore concepts, and determine the capabilities and solutions to meet these future challenges. Its initial efforts for the Marine Corps are focused on response to asymmetric threats at the Marine Expeditionary Unit level.

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**The Office of Science, Technology, and Integration (OSTI).** The OSTI oversees the Marine Corps Science and Technology Process aimed at enhancing the warfighting capabilities of the Marine Corps. It develops the vision, policies, and strategies to exploit scientific research and technology development. It integrates and focuses the S&T efforts in support of experimentation and the Combat Development System.

**Command Division.** The command division includes a number of functions that support the command as a whole.

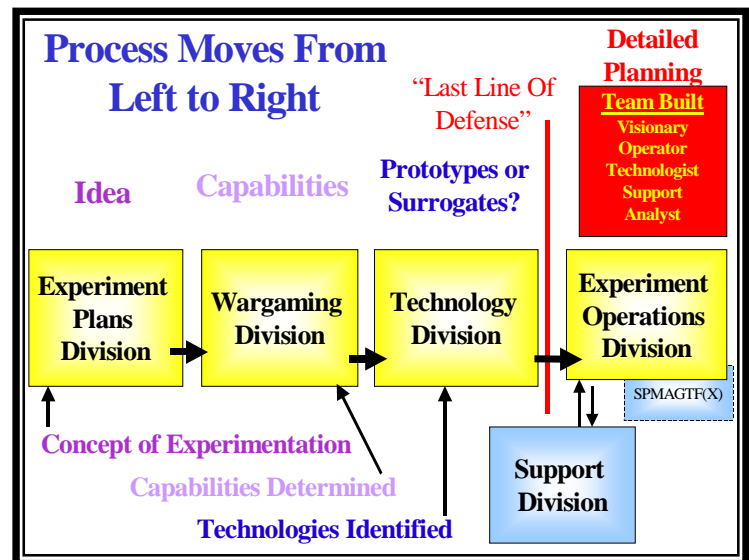
- The *Business Office* manages the Lab's budget and coordinates its contracting functions with the MARCORSYSCOM.
- The *Analysis Office* consists of on-site analysts from the Center for Naval Analysis to collect and analyze experimentation data as an integral part of the Lab's experimentation.
- The *Public Affairs Office* coordinates media inquiries and plans for media visits to major experimentation venues.
- The *Synthesis Office* captures the results of experimentation that is of immediate interest to the Marine Corps and distributes that information in the form of X-Files. They are distributed in booklet form or can be downloaded from the Lab's Web Site: [www.mcwl.quantico.usmc.mil](http://www.mcwl.quantico.usmc.mil).

## Experiment Plans Division

The Innovation and Experimentation Process is reflected in the organization of the five major divisions of the Lab. Typically, the experimentation process progresses from left to right across the various divisions as indicated in the accompanying chart.

Experiment Plans Division develops and publishes experimentation direction that establishes priorities and drives the experimentation process within the Lab.

As indicated in the Innovation and Experimentation Chart on page 1-3, experimentation supports a number of agencies involved in the Marine Corps Combat Development System. Not shown on that chart are Marine Air-Ground Task-Force Component Advocates for the Command Element, Ground Combat Element, Air Combat Element, Combat Service Support Element, and Support Establishment Element. The Experiment Plans Branch must establish priorities that not only adequately address the needs of the agencies listed in the top block on the chart on page I-3 but also the warfighting



deficiencies and desired future capabilities that are within the purview of the Advocates.

Because of increased focus on how future Marine Corps capabilities contribute to Joint Concept Development and Experimentation (JCDE) under the cognizance of Joint Forces Command (JFCOM), the Experiment Plans Division integrates service experimentation priorities with the need to adequately support

Joint experimentation priorities. Section III contains the concept and objectives for Joint experimentation during Millennium Challenge 02 (MC02) and planning direction for subsequent joint experiments.

Integrating the direction into a coherent plan for experimentation is a function that requires iterative coordination and discussion with the various Service and Joint claimants.

Experiment Plans Division formulates the concepts for experimentation (ideas) into outlines for projects and experimentation initiatives.

In addition, Experiment Plans Division sponsors wargames to refine concepts for experimentation and identify the necessary capabilities to implement the idea, coordinate with the technology division as to potential technology solutions for capability shortfalls, and then sponsor a final coordination meeting with Experiment Technology and Operations Divisions to formulate a team to conduct the detailed planning and execute the experiment.

To accomplish these tasks, Experiment Plans Division is divided into three branches:

- *The Service Experimentation Branch* coordinates with the Component Advocates and the various claimants within the CDS (to include the ONR Future Naval Capabilities (FNC)) to develop the Service experimentation requirements.
- *The Joint Experimentation Branch* exercises staff cognizance to plan Marine Corps participation in Joint Experimentation. In this capacity, the Joint Experimentation Branch specifically coordinates Joint experiment planning efforts in support of JFCOM-sponsored Joint experiments in coordination with MARFORLANT.

- *The Concepts Integration Branch* documents the planning effort for the Lab, maintains and publishes the *Experimentation Campaign Plan* that serves as a guide for the experimentation efforts of the entire Lab and tracks the process from concept through transition into future capabilities.

## Wargaming Division

The Wargaming Division both influences the concepts for future capabilities that is the beginning step in developing experimentation direction and is used to refine the concepts to determine the required implementing capabilities. In addition, wargaming is used to assess the results of experimentation and to develop consensus as to how the results of experimentation should impact the Combat Development System. The Wargaming Division is discussed in greater detail in Section II.

## Technology Division

The Technology Division identifies candidate technology solutions to support experimental capabilities. The technology solutions may be prototype systems available through MARCORSYSCOM or other government organizations such as ONR FNCs or from the Naval Research Laboratory. Likewise, the candidate solutions may be surrogate systems developed by DARPA or ONR, or commercial off-the-shelf systems available from industry.

Emerging technology may also present opportunities for new experimentation concepts. Accordingly, the Technology Division is a key participant in wargaming and concept development.

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### Support Division

Support Division provides logistics and material support to the Experiment Operations Division for experimentation. The Division provides both planning – to include estimates in cost and supportability – and execution support to deployed elements with contracting and material support.

### Experiment Operations Division

Experiment Operations Division conducts experiments within the Lab. It executes experiments both in the capacity as a Division of the Lab and as a formally constituted Special Purpose Marine Air-Ground Task Force (Experimental) Command Element.

The Director of the Experiment Operations Division is also Commanding Officer, SPMAGTF (X). The SPMAGTF (X) can be assigned to the *operational control* (OPCON) of one of the Marine Expeditionary Forces (MEFs) and assume command of elements of the operating forces in order to conduct experiments.

When not under the OPCON of one of the MEFs for a major experiment, the SPMAGTF (X) is embedded within the Lab as the nucleus Experimentation Operations Division in the same manner that a command element for a Marine Expeditionary Brigade is embedded within the command element of its MEF. On a daily basis, personnel operate in assigned billets within the Lab and are recalled to man the SPMAGTF (X) command element as required to support experimentation.

The Operations Division performs three primary functions:

- *Detailed Experiment Planning*: develops the detailed experimentation plan in order

to accomplish the experimentation objectives within assigned resource restraints. [When a specific project team is formed for a functional experiment, it completes its planning and coordination functions as an integral part of Experimentation Operations.]

- *Experiment Execution*: coordinates all experimentation [to include LTAs conducted by the Technology Branch when conducted with the operating forces]. Executes all LOEs and AWEs on behalf of the Lab.
- *Experiment Assessments*: develops operational assessment reports – as differentiated from an analytic report completed by staff CNA analysts – for major LOE and all AWE. In addition, oversees the development of transition documentation (TTPs, UNS, MNS, ORDs, POI recommendations, etc.)

Each of these functions is discussed in detail in the following paragraphs.

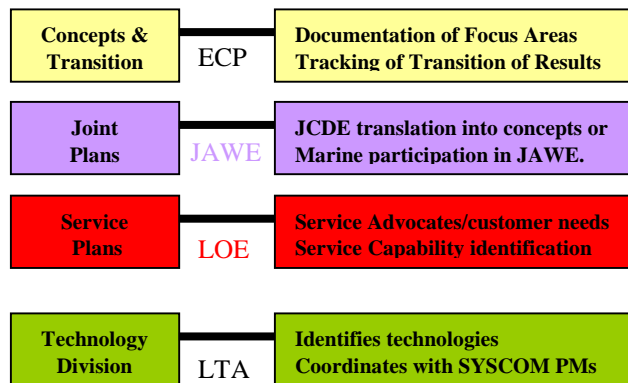
## EXPERIMENT PLANNING

### General Planning

Experiment Plans Division conducts *general planning* for experimentation; Experiment Operations Division conducts *detailed planning* using the concept of operations developed during general planning. The three branches of Experiment Plans Division and the Technology Division conduct distinct general planning functions.

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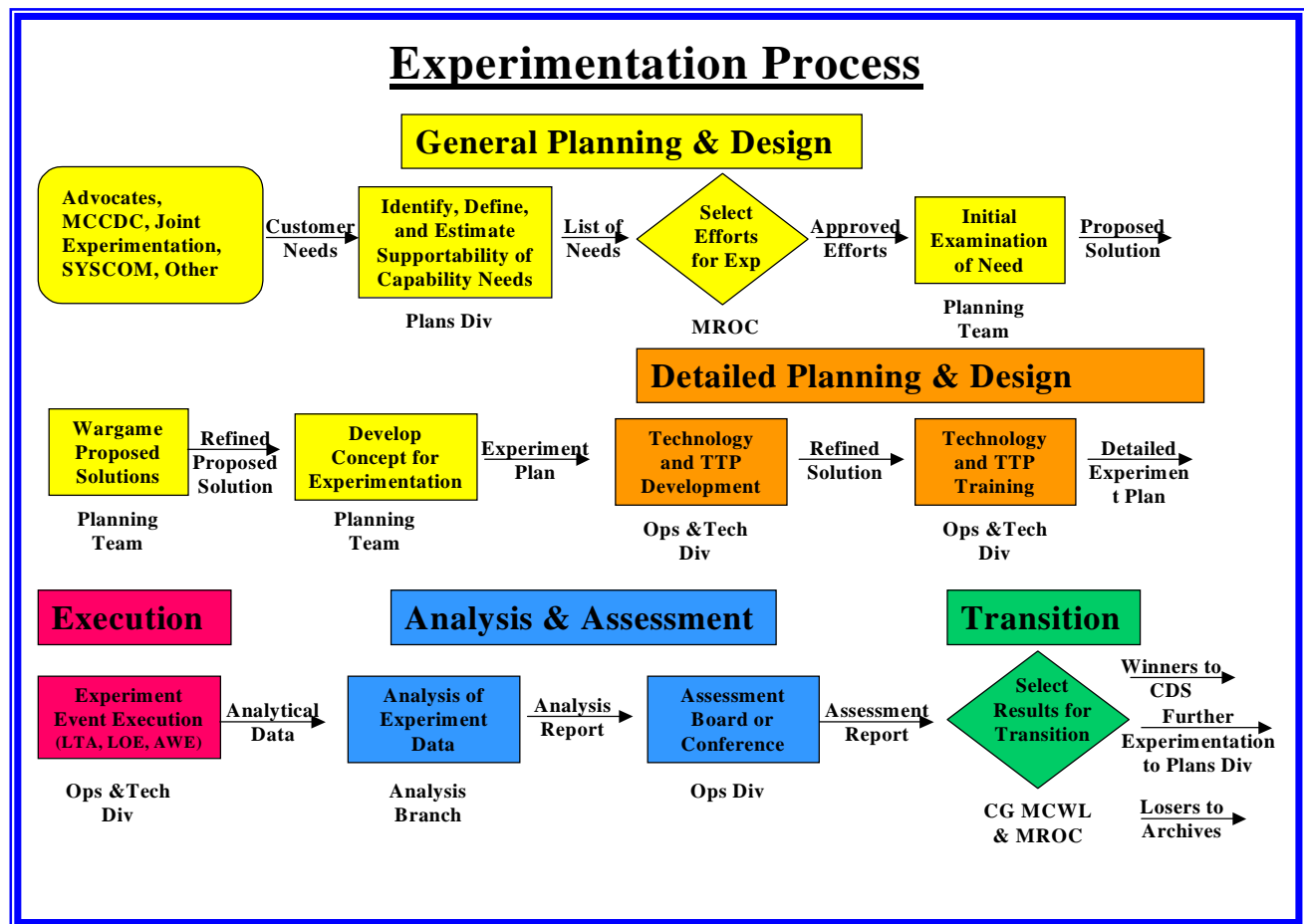
# EXPERIMENTATION CAMPAIGN PLAN -- 2001



## Establishing Direction

The Concepts Integration Branch establishes the future direction for experimentation. Although planning is ongoing, ideally it is conducted on an annual basis to develop definition for Lab focus areas and major projects as follows:

- **Purpose.** In general terms describe what the focus area or major project is to accomplish and why do it. Typically the identification of Capability Needs is done *in part* through coordination with the Advocates but also through a variety of wargaming and assessment forums in support of emerging concepts and to take advantage of technological opportunities.
- **Product(s).** What is the effort going to produce? (Report, UNS, POI, prototype etc). Is the product described enough that the customer understands what he will be getting and that it will answer his need. Who will receive the deliverable product? This should be someone in the Combat Development System not the operating forces.



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- *Need Documentation.* Indicate the source of the need the Lab is trying to support. This could be concept definition to develop an UNS, the DOTES Assessment of an UNS to determine solution COAs, providing support to a solution developer e.g. TECOM, Doctrine, MARCORSYSCOM
- *Advocate(s).* Indicate, which Advocate (Aviation, Ground, Command Element, CSS, Supporting Establishment) the initiative falls under. Also indicate if the initiative supports a specific requirement in the Advocates campaign plan.

The Concepts Integration Branch uses the products of this planning effort to develop a recommended list of experimentation efforts that the Lab can support. This prioritized list is formulated as a proposed set of *Focus and Supporting Areas of Emphasis* and anticipated major experimentation events. It is briefed to the Advocates/MROC for final approval. Once approved, the list is the basis for the Lab's allocation of resources and documented through the publication of the ECP.

### Joint Experimentation Planning

The Joint Plans Branch conducts planning in coordination with MARFORLANT for Marine Corps participation in Joint experiments as part of the JCDE. General Planning for Joint AWEs differ considerably from other planning efforts.

Joint planning begins with a date for a planned JAWE and an experimental Joint concept – such as *Rapid Decisive Operations (RDO)* – and a Joint Concept for Experimentation. It is then up to the Service to develop their own plans for supporting the concept and for

defining Service experimentation within the Joint experimentation objectives. <sup>16 July 2001</sup>

The Joint Branch serves as the JCDE planning and coordination cell for MARFORLANT. Instead of developing experimental capabilities, the primary focus of the Joint Plans Branch is in developing a concept by which the Marine Corps can showcase specific Marine-specific operational capabilities in meeting Joint experimental objectives.

General planning for Marine participation in JAWE involves identification of operational forces required to support Marine participation objectives so that MARFORLANT can coordinate tasking and the identification of experimental technologies and capabilities from the ONR FNCs and Service experimentation that can be showcased in meeting Joint objectives. Section III of the ECP describes the Lab's support of Joint Experimentation in greater detail.

### Planning for Service Capability Development

Service Plans Branch develops concepts for Service experimentation that support the needs of Service Advocates and functional managers within the Combat Development System such as TECOM, WDID, etc., and ONR's FNCs.

#### Concept of Experimentation Elements

- Capability Needs that will be the Object of Experimentation
- Product end state; Need Documentation; CDS Customer or; Advocate
- Planning Considerations (Assumptions, Restraints, Constraints)
- Objectives and Proposed Hypotheses
- Proposed Experimental Solutions
- Concept of Operations for Experimentation
- Proposed Schedule
- Tasks for the divisions of the Lab
- Personnel, Support Requirements, and Resources
- Command Relations and Coordination Requirements

The product of this step is a *Capability Need* that describes what is needed, how it fits into the larger warfighting picture and key relationships with other capabilities and warfighting functions. The elements of a *Capability Need* are virtually identical to the elements of a Universal Need Statement.

## Capability Need

- **Type of Need** (is it an added capability or an improvement to an existing capability)
- **Description of Need** (describe nature and cause of need and how identified)
- **Organization or Individual:** (that requires the capability)
- **Mission or Task** (Describe the mission or task that the organization or individual needs to accomplish that is related to the need and how the added or improved capability will improve the ability to perform the mission or task)

The Service Plans branch translates the capability need into proposed solution for experimentation within one of the Focus Areas. Alternatively, it can propose the formation of a Project Team to further develop a specific capability either separate from, or in support of, a focus area.

## Proposed Solution

- **Concept of Employment:**
  - Concept of how an organization or individual would employ the experimental technologies and tactics, techniques and procedures to meet the capability deficiency.
  - Consider Doctrine, Organization, Training, Equipment, and Support (DOTES). What is the notional T/E, will the capability require formal training etc.
- **Assessment of Relative Value:**
  - How is it different from present
  - How the solution is employed with or relates to other experimental initiatives or current capabilities.
  - How does the experimental solution link to Joint and Service concepts?

**Generate a Functional Hypothesis.** The first step in the Lab's experiment planning and design process is to generate the experimental hypothesis. This includes establishing the

objectives that can be tested to prove or disprove the hypothesis. This includes writing the objectives that can be tested to prove or disprove the hypothesis. Writing the objectives usually means articulating the existing hypothesis clearly and adding sufficient detail so that an experiment can be designed around it. For example:

*Concept: "I think this rifle would help the Marines fight better."*

**Hypothesis:**

*"If a Marine infantry unit is equipped with the experimental rifle instead of their current rifle, then they will be more combat effective, able to shoot more accurately and more lethally, consume less ammunition, and will be required to perform less weapon maintenance."*

The hypothesis above has these three key components.

- The hypothesis identifies a cause (the new rifle) and effect (greater combat effectiveness). The cause and effect are sometimes referred to as the independent and dependent variables, respectively.
- The effect, or dependent variable, is specified in terms of things that can be observed. It is feasible to objectively measure accuracy, lethality, and maintenance time. Determining whether Marines *fight better* is much harder.
- The hypothesis specifies a baseline case so it is clear that the issue is the potential replacement of the existing rifle.

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- The difference between performance of the current equipment and the experimental equipment should be measurable.

### ***Hypothesis Defined:***

1. *A tentative explanation that accounts for a set of facts and can be tested by further investigation; a theory.*
2. *Something taken to be true for the purpose of argument or investigation; an assumption.*
3. *The antecedent of a conditional statement.*

*Source: The American Heritage Dictionary, Third Edition; Houghton Mifflin Company ©1997.*

**Wargaming.** Wargaming will normally precede simulated and field experimentation. During wargaming these proposed solutions are subjected to an adversarial wargame. The wargame critiques the feasibility of the concept of employment of TTPs and technologies. The wargame includes a cell that represents the threat perspective.

The cycle of solution development and wargaming is continued until a viable experimental solution is developed or a determination is made that continued experimentation is not feasible or recommended

### **Technology Development**

Ideally, technology development is done through the Office of Naval Research or the MARCORSYSCOM Programs of Record. However, when the necessary technology is not available to provide the anticipated capability solutions, the Technology Division may contract to develop the necessary surrogate or prototype technology solutions.

To be effective in providing adequate search of the available candidate technology solutions to desired capabilities, the Technology Branch must be involved early in the general planning process. Once a candidate technology solution is identified, the Technology Branch will develop their own LTAs to test whether the items perform as desired and to determine the training and tactical procedures that will be needed before the technology systems can be used in operational experiments.

Note that when LTAs involve operating forces, the coordination and conduct of the experiments are coordinated – and sometimes executed – though the Experiment Operations Division.

### **Develop Concept of Operations for Experimentation.**

During this step a planning team develops the basic framework for the experiment. The principal issue is defining the general experiment scope. This typically involves an estimate of the nature and type of experimentation that will be required to fully assess the experimental capabilities.

For example, will it require discussion/seminars, wargames, simulations, field-experiments such as LTA and LOE? Will it require the development of prototypes or involve surrogates for technology that is not available today? Will it require the formation of a Project Team to conduct iterative experimentation or supporting functions before an answer to the experimentation questions are answered?

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### Last Line of Defense

Ideas for experiments transition into execution through a *Decision Brief* of the *Concept of Experimentation*. For complex experimentation proposals the Decision Brief may be presented formally to the Commanding General and the collected senior leadership of the Lab. For lesser initiatives, it may be completed using a desktop brief.

Regardless of the scope of the Decision Brief, the intent is the same: before committing resources in pursuit of a capability, ensure that the general planning process has identified a proposed experimental solution that is executable within acceptable resources.

When the *Director of Experimentation Operations* considers the *Concept of Experimentation* executable – it crosses the *last line of defense* – and it is accepted for detailed planning by the Operations Project Team. The detailed planning includes coordination with operating forces; development of detailed experimentation plans to include preliminary training or testing of experimental equipment, and coordination with vendors or supporting organizations.

### DETAILED EXPERIMENT PLANNING

Detailed Experiment Planning begins formally when the Concept of Experimentation is accepted for execution. The Operations Division will institute detailed planning built around a Project Team.

The Project Team typically involves at least four individuals: a conceptualist, an operator, an analyst, and a support person. Technologists may be added if the experimental solution is technology oriented. Ideally the entire nucleus Project Team is expected to work on the project through

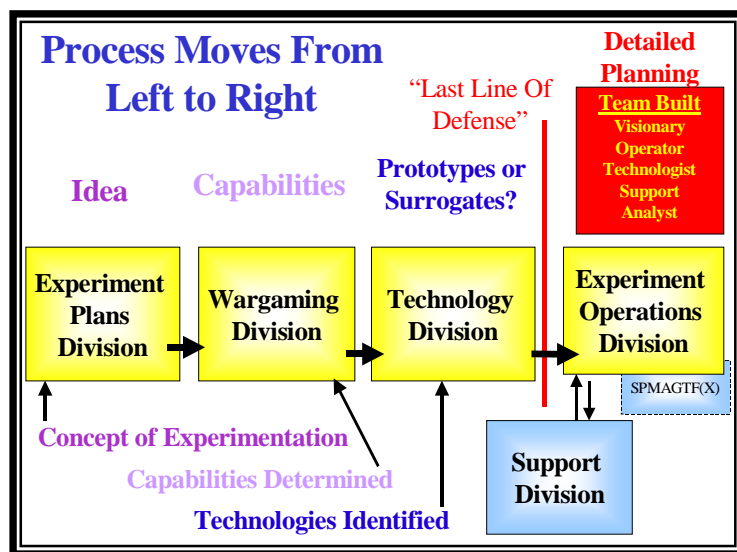
completion and transition of the final experimentation product.

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The Project Team will commence detailed planning under the supervision of the Director of Experiment Operations and may employ an IPT format involving representatives not only of the Operations Division but also the rest of the Lab.

**Measurement.** The Lab's experiments are attempts to measure the effect of doing an operation in a new way. Therefore, all of the Lab's experiments involve some kind of measurement.

**Baseline Measurement.** Experimental measurement is uninformative without an accompanying baseline measurement to give it context. Here is a good way to understand this. Measurements are of two types: *absolute* and *relative*. An absolute measurement of temperature would tell you the temperature is 45°F outside. That number by itself is not very meaningful unless it is understood that 30°F is cold, 70°F is pleasant, and 100°F is hot. The



latter three numbers provide a context or *baseline* for the temperature measurement. Given an understanding of the above baseline

temperature context, one can reason that he should wear a jacket if he is going outside. In the same way that a single temperature is uninformative by itself, a single experimental measurement is uninformative without an accompanying baseline measurement to give it context. Experimental scientists refer to baseline measurement as an *experiment control*.

**Observing a measurable change in capabilities is the only way that we can learn about the effects of experimental technology and/or experimental TTPs.**

### **Importance of Baseline Measurements.**

Even the most rudimentary military operations involve significant complexity. For example, all military operations are affected by uncontrollable factors such as weather, threat posture and morale. Military operations are also affected by training level, equipment and supply readiness, time available and the like. Given these multiple variables, all of the Lab's experiments must have baseline measurements.

**Controlling Variables.** Experiment designers simply cannot anticipate, and *design away* complicating factors – variables -- in a military operation. Therefore, in a baseline experiment used for comparison of the experimental measurement, nothing should change except the experimental capability. That way, weather, threat posture, etc., will exert similar influence on both the baseline and the experiment, and will not—on their own—cause a difference between the two iterations. Ideally, the only difference between the baseline and the experiment is the experimental technology or TTP. When that is the case, any observed difference in the accomplishment of a tactical task is attributed to the experimental capability.

**Subjective Baseline.** When the experimental

rifle is presented to an infantry squad and observed in an operation, the Lab may find that they accomplish their tactical task in four hours, fire 2000 rounds, and suffer two casualties. An experienced Marine could probably offer an opinion as to whether the squad's performance was *good* or *bad*. The experienced Marine makes this judgment by comparing the performance of the squad in the experiment to a baseline he has set in his mind as a result of seeing and participating in numerous similar evolutions throughout his career. He has a built-in baseline he is using for comparison. However, there is no guarantee that two experienced Marines would share the same opinion about the experimental squad's performance. They probably have different sets of experiences, forming *different, subjective*, baselines. There is no assurance whose baseline or opinion is *correct*.

**Objective Baseline.** A more reliable baseline would come from observing the same squad executing the same operation under the same conditions as the experiment, except that they use their current rifles instead of the experimental rifles. The experiment would center on tracking the same performance measures in both cases, and then determining if any difference in performance can be attributed to the difference in rifles. Eliminating cost as a variable, this would determine *objectively*, whether or not the experimental rifle is superior to the current rifle.

**Reality Sets In.** Notwithstanding the above discussion, there is no such thing as a perfect experiment or a perfect baseline. Two factors will always confound our attempts at perfect experimentation:

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- *Artificiality.* As is the case with any testing or training, it is impossible to accurately replicate real combat. These differences between real combat and experiment are artificialities.
- *Limited Circumstances.* Even if real combat were replicable, it would still be of limited value because it only represents a single set of circumstances. For example, experimentation in daytime doesn't prove how something will work at night, and experimenting in the cold doesn't reveal factors that are important when it's hot, and so on.

**Artificiality Happens.** Artificialities occur because warfighting experiments simulate real combat. Real ammunition in force-on-force combat is not possible for the sake of finding out how effective a new rifle will be. There are alternatives that aid in simulating reality, *Simunitions* (paint ball type rounds) or the Multiple Integrated Laser Engagement System (MILES) can be used as surrogates for real bullets. Surrogates do not perfectly emulate the performance of the things they replace. MILES signals don't penetrate walls, and *Simunitions* don't have the same range as a rifle round, etc. In addition, experiment participants know they are not shooting live rounds, or really going to be hurt or killed, so they may not behave realistically.

### Dealing with Artificialities.

All experiments have inevitable artificialities that can have a significant impact on quantitative (objective) data. Thus, experiments are designed carefully to:

- Minimize the impact of the artificialities that are most critical to the particular data that must be collected to meet objectives,
- Pair quantitative data with informed,

qualitative (subjective) observation. <sup>16 July 2001</sup>

### Tactical Experimental Methodology.

Experiments are driven by operational considerations in a tactical scenario. The goal is to see if some change to the current way of operating will help Marines do a better job in performing their mission essential tactical tasks.

Within resource limits, experiments are sequential and iterative. They build on previous experiments while staying focused on measurable slices of the problem. During a seven or eight day experiment, this cycle is often measured in hours and seldom exceeds one day. The experiment team applies this experimental methodology.

TRAIN ► EXPERIMENT ► ASSESS ► LEARN ►  
DEVELOP QUICK FIXES ► ADJUST OUR APPROACH ►  
RETRAIN ► APPLY TO THE NEXT EXPERIMENT.

### Train Before Experimentation. If

The users are not confident in experimental equipment and/or experimental TTPs; they will not realistically employ them during the experiment. This renders the resulting data unreliable. Success in assessing the impact of the experiment on an individual or a unit is only achieved after a period of time during which the users become intimately familiar with the experimental equipment, technology, or TTP and integrate its use into their standing operating procedures.

On the other hand, if not instituted with care, training can become a source of artificiality. To avoid this, experimenters should accomplish the following actions *before* beginning the experiment:

- Conduct familiarization training for unit leaders and operators.
- Test operator proficiency and unit leaders

and operators.

- Exercise the capabilities in a variety of tactical vignettes or situations.
- Conduct follow-on training to correct deficiencies or modify operator procedures or TTPs for employment based on lessons learned during training.

**Only after reaching an adequate level of training proficiency should there be any attempt to assess the military utility of a new technology using an LOE or AWE. Trying to do this without adequate training and formulation of effective TTPs generally results in failure to get reliable data.**

**You Can Never Do Enough.** Ideally, the Lab should collect large comprehensive sets of data by repeating an experiment over and over under different conditions and using different participants, so conclusions would be widely applicable. In reality, however, sufficient iterative experimentation under every potential tactical situation and environment is impractical given resource limitations. Therefore, rarely are all the desirable iterations conducted.

**Some subjective judgments are useful influences to observations and conclusions when it is needed to compensate for artificiality and when it helps understanding of the limitations of objective measurements.**

Instead, choose experimental conditions carefully, temper objective measures with subjective observations, and understand the limitations on what conclusions can be drawn from the experiment(s). Within this framework – especially when experimenting with new TTPs – plan iterations carefully to optimize experimentation conditions and unit combinations.

Training of participants to a common baseline to permit employment of the experimental

TTPs is one factor. However, the real value of iterative experimentation is to provide the opportunity for sufficient tests to permit isolation of the specific factors that result in measurable improvements in performance.

## **Combining Subjective and Objective**

**Output.** The Lab strives for objective, quantitative measurement of experimentation whenever possible. In the case of an experimental baseline, an objective measure is critical because without it experimental measures are meaningless, or at least highly disputable. But, because the opportunity to achieve objective measures is often limited, objective observation is often augmented by subjective observation, experience, and judgment.

## **Demonstrations and Discovery Learning.**

The Lab occasionally conducts *evolutions* that look like an experiment, but with no accompanying baseline. Two occasions when a baseline measurement is *not* required are:

- When the evolution is a *demonstration*
- When the goal of the evolution is *discovery learning*.

**Demonstrations.** Demonstrations are conducted to prove to the Lab and others that it is possible to execute some complex process, to test systems, or to identify the difficulties that will be encountered when executing a new process. Sometimes it is necessary to execute a demonstration to learn about a TTP or technology before it is incorporated into an experiment.

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### Sample Demonstration Objectives

- Demonstrate the current capabilities of the Lab's experimental command and control systems and identify remaining deficiencies in order to recommend future courses of action for development and experimentation.
- Demonstrate the ability to track casualties through the casualty care system.
- Demonstrate the ability to automate and integrate the logistics functions of a MAGTF.
- Demonstrate the ability to automate the fusion of input from a full spectrum of collection assets that can be incorporated into a Common tactical Picture.
- Provide an assessment of the Navy initiatives involving Network-Centric Naval Surface Fire Support and associated systems as to the implications in LPD-17 landing Force Operations Center design.

**Discovery Learning.** Discovery learning is a process that allows experimenters and developers of technologies or TTPs to receive input from operational forces or to stimulate refinement of technologies or TTPs by implementing abstract ideas in a concrete setting.

Discovery learning answers questions like:

*Are Marines more effective when equipped with a particular new item of equipment?*

To answer this question, the Lab might issue the experimental equipment to a group of Marines in the course of carrying out some tactical task and watch what they do with it. Discovery learning is high risk because it relies on the creativity of specific participants. It is entirely possible to execute a discovery learning experiment and learn nothing. On the other hand, discovery learning may have a high payoff because creative, *outside the box*, ideas may result. The qualitative results of discovery learning still need to be evaluated by standard

experimentation in order to understand<sup>16 July 2001</sup> whether they contribute to warfighting.

*How can the Lab learn whether a new technology will help Marines fight better if it doesn't even exist yet?*

**Surrogates.** Often, the Lab pursues questions related to technologies that are not yet available. In this case the Lab is trying to figure out whether the Marine Corps should devote resources to development of the new technologies.

An experiment designed to promote understanding of the *capability* the prospective technology is expected to deliver may be put together using a surrogate—a combination of items that generate at least a reasonable simulation of the desired capability.

For example, the Lab can mount a gyro stabilized, high definition video camera in a helicopter and transmit pictures and targeting information to a Combat Operations Center. This is a surrogate that simulates the capability of a small unmanned aerial vehicle targeting camera that is not yet in production. The goal here is to provide enough information about that capability to stimulate an informed decision as to whether or not to pursue its development.

**Use But Don't Evaluate Surrogates.** The purpose of an experiment using a technology surrogate is not to evaluate the performance of the surrogate. Surrogate systems, by definition, should never be developed beyond the experimental stage so how well they work is immaterial. It is easy to become confused on this point because generally data is collected on surrogates to verify how well they work. The issue is the *capabilities* of the surrogates because the only way to know if the

experiment is using a particular capability is to be sure the surrogate has delivered that capability. Performance data are not the goal of an experiment; instead, data confirm that the proper experiment has been conducted.

**The capabilities of a surrogate must be designed carefully. The surrogate has to work well enough to represent a new capability, but if its capability is too comprehensive or too perfect the experiment's results will be skewed.**

**Difference Between a Surrogate and a Prototype.** A prototype differs from a surrogate in that it is a phase in the development of an actual system that will be developed for the operating forces. The Lab occasionally experiments with prototypes to evaluate their performance in order to contribute operational input to the development process -- or to help the Marine Corps decide if it should pursue a developing technology. When an experiment uses prototypes, the Lab legitimately collects data on how well they work.

## EXPERIMENT EXECUTION

**Difference Between an Experiment and an Exercise.** Once an experiment enters the execution phase, it looks very much like an exercise, and many of the same planning and logistics considerations apply. However, the goal of an experiment is different from that of an exercise. To a large extent, the goal of an exercise is achieved simply by carrying out the operation—that is—participants refresh or sustain their knowledge and skills simply by participating.

An experiment is different because its goal is developing new knowledge for a specific

purpose, rather than conveying existing knowledge to the exercise participants.

**During the execution phase of an experiment, we see the ideas that underlie our experimental hypotheses implemented as concrete technologies or TTPs and we want to learn if they deliver the hypothesized increased combat capability.**

Turning an experimental evolution into new knowledge requires collecting data during the event, analyzing that data after the event is complete, and documentation and distribution of the new knowledge. The contribution of the live experiment is to provide the data which are later developed into knowledge.

**Collecting Essential Data.** Data collection often places an extra burden on the experiment participants. They are required to carry tracking devices, fill out questionnaires, sit through long debriefs. They also must drag numerous observer/controllers (O/Cs) and analysts along with them during the experiment. However, this on-the-spot data collection is essential despite the burden it places on participants and O/Cs. If data is not recorded on events as they occur, then too much reliance is placed on post event reconstructions and debriefs for key data.

**Data collection is not an interruption of the experiment's routine – it is the reason for it!**

**Mission Failure Versus Experiment Failure.** From an experimental standpoint, failure to accomplish the military objective may be every bit as successful as accomplishing the military objective. If an experimental technology doesn't work--or is not useful--the experiment may still be a *success*. The experiment may have saved the Marine Corps the resources that

would otherwise have been devoted to a technology or TTP that is not useful.

**There is No Success Without Data.** Even if an experiment goes smoothly, the experimental systems work, the participants win the battle, achieve their objective, but no data are collected the experiment is a *failure*. Failure occurs when *why* things worked, and *how* experiment participants used the experimental gear or TTPs cannot be documented. This is only done through analysis of data that can be synthesized into new knowledge.

**Beware of Work-Arounds.** Plans rarely survive implementation, and experiment plans are no exception. How participants react to the inevitable glitches that come up during the course of an experiment is critical to its outcome and often very different from the way they should respond during an exercise. Once again, this is a fundamental difference between experimentation and warfare.

When experimenting with a prototype technology or TTP that does not deliver the hypothesized combat capability benefit, the Experimentation Force may find themselves failing to accomplish the tactical task given to them in the experiment scenario. The natural reaction of Marines in this situation is to implement work-arounds. Their inclination is figure out some way to accomplish their tactical task that doesn't rely on the experimental technology and forge ahead. While this kind of determination is admirable in an exercise or operation it often does not lead to collection of useful experimental data.

For example, in assessing an experimental rifle that does not perform as expected, more is learned about the impact if the experimental unit fails miserably in their mission, than if they use the experimental rifles to bludgeon

their enemies to death and accomplish the military objective in spite of the rifle's failure to perform properly. The same is true with experimental TTPs. A unit that chooses to respond to a situation with their old TTPs rather than fully employing the new TTPs – even if the result is that the tactical task is accomplished – results in no usable experimentation data.

**Fix the Surrogates, but Let the Prototypes Fail.** In general, the guideline for dealing with technical problems during experiments is to stop and fix the surrogates, but let the prototypes fail

Frequently technology surrogates are lashed together from commercial off-the-shelf components and are not as rugged and robust as a real system would have to be. Thus, surrogates can and will occasionally fail. When this happens, the proper response is almost never to work around the problem nor to continue with the experiment, allowing the surrogate's failure to cause a mission failure. Failure of a surrogate to perform as expected is an artificiality and its impact on the experiment should be minimized to the greatest extent possible. Sometimes this means calling a pause in the experiment (PauseEx) until repairs can be made to the surrogate.

However, since there is data collected on how well a prototype works, a failure of this technology is not artificiality and the experiment participants have no need to call a PauseEx to fix it.

**To Pause or Not to Pause.** Every experiment is different. Sometimes the impact of pausing action is more profound than the impact of the surrogate's failure. The proper course of action must be determined by the experiment controllers at the time of the failure, but this

decision needs to be made in light of a clear understanding of the experiment's objectives. Because the goals of an experiment are different from those of most other evolutions that Marines are accustomed to executing it is advisable to think about appropriate responses to potential failures before they happen.

### **The Experiment's Not Over Until the Paper Work is Done and the Decision is Made.**

The third stage of experimentation is the assessment and analysis of the experiment. This stage is the critical culmination of the first two stages of the Experiment Operations Division's responsibilities. The effectiveness of this third stage is a direct result of the effectiveness of the first and second phase.

The most effective experiments are planned and conducted with a view towards facilitating this critical third stage. Under the direction of the Experiment Operations Division, two concurrent efforts are conducted:

**Analysis** – the analysts reconstruct the experiment using both quantitative and subjective data collected in accordance with the data collection plan formulated during the Detailed Planning Phase. The analysis has two goals: (1) determine the extent to which the experimental data address the stated objectives, and (2) identify relevant observations and lessons learned. The result is presented in the form of an independent report.

**Assessment** – all experiments result in an operational assessment. Responsibility for the assessment is determined during detailed planning. Technology Division typically assesses LTA. LOE and AWE assessment reports are typically developed by a senior representative from the Experimental Operations Division either as a result of an Assessment Board or conference of experiment participants. The objective is

assesses whether experimental objectives have been met and recommend actions on each experimental concept or technology as well as other topics of interest that emerge. The assessment report is forwarded to the Commanding General for approval.

Assessments are conducted separately from the analysis although the analysts must participate in the assessment to provide comments as to whether analytic data supports the subjective findings of the assessment participants.

**Assessment Report.** The Assessment Report will generally categorize experimental results in terms of *winners*, *losers* and those efforts that require *further experimentation*.

- **Winners** -- Experimental products recommended for transition to CDS.
- **Losers** -- Experimental products that are failures (provide no solution to an identified need) and will not be subject to further experimentation or transition efforts.
- **Further Experimentation** -- Experimental efforts recommended for continued experimentation

The format of the results will vary depending on the type of experimentation and deliverable product. By endorsement, the Commanding General will concur or non-concur with the recommendations and issues orders directing action on each experimental initiative.

Even after the analysis and assessment reports are prepared, institutional acceptance of the results of experimentation may require extensive follow-up efforts. Successful experimentation results in decisions either to implement or not to implement an idea for improving combat capability.

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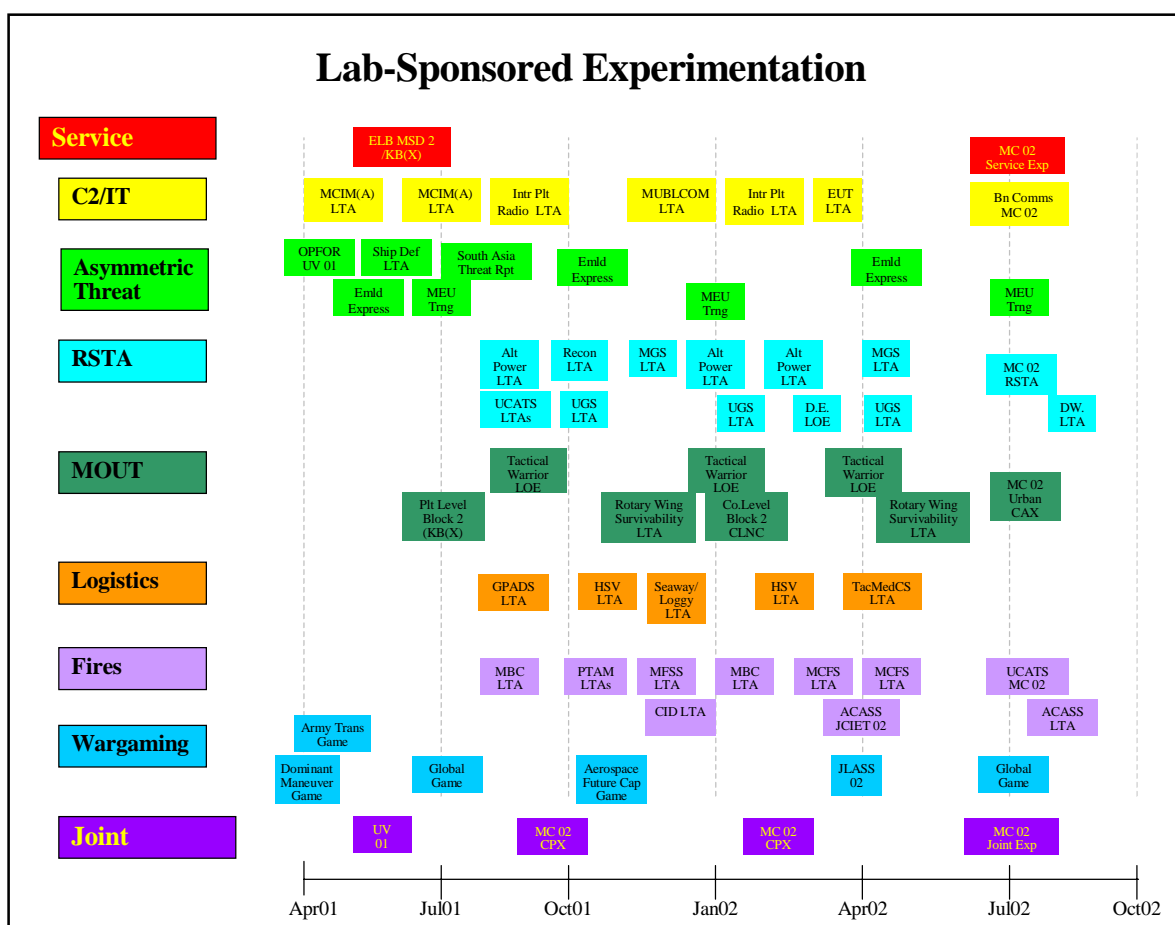
Experimentation reports are the means to that end and never the end itself. Assessment and Analysis Reports are distributed to Marine Corps and DoD activities, and initiative sponsors as appropriate.

**Transition and Tracking of Experimental Results Based** on the Commanding General's endorsement of the assessment report, the results will be acted upon as follows:

- **Winners** must be packaged for transition to the appropriate customer. Generally, The Project Team completes development of the completed transition products – such as TTPs, UNS, MNS, ORDs, or POI – before the team is disbanded.

- **Losers** are identified and supporting documentation is archived so that the fact that it was declared a dead end reduces the chances that resources will be expended on this approach in the future.
- Efforts requiring *further experimentation* are redirected into the planning process.

Technology Division -- or the Concepts Integration Branch of the Experiment Plans Division -- tracks capability initiative status as appropriate.



## COMMAND AND CONTROL & INFORMATION TECHNOLOGIES (C2IT)

### The Problem

Current and projected Command and Control systems do not support the C2 future vision, as expressed in *Beyond C2*, nor the seabased C2 requirements of *Operational Maneuver From the Sea* (OMFTS) and *Ship-to-Objective Maneuver* (STOM).

Missing are a number of specific C2/IT capabilities such as the following:

- Wide-band, over- the-horizon (OTH), communications architecture.
- Integrated expeditionary C2 system that is capable of supporting a distributed Common Tactical Picture (CTP) across the entire MAGTF afloat and ashore.
- Software capable of integrating the Joint Common Relevant Operating Picture (CROP) into the Marine component and MAGTF C2 system.
- Decision support systems available at all levels to specifically include the infantry battalion.
- Computer end user terminals to support tactical access to the CTP and CROP.
- Lightweight, durable, secure tactical communications within the infantry platoon.

Exploring the means to remedy these shortfalls is the goal of the Lab's C2/IT focus effort. At the tactical level, the effort is from the bottom up. At the operational level, the focus is at providing the capabilities for the Marine Corps operating forces to function more effectively in the context of the JFCOM operational concepts.

### The Lab's IT Experimentation Legacy

The Lab's initial five-year plan -- the *Warrior Series* of Experiments -- was designed specifically with the exploration of these fundamental shortfalls became the centerpiece of Lab C2IT experimentation effort.

This exploration effort included a range of efforts to include wireless communications, intelligent agent decision support systems, digital tactical communications in lieu of voice communications, and the employment of tactical computers as a means of exploiting distributed databases and the CTP.

Some of the experimentation has led to immediate improvements in capability of the operating forces. For example, as a result of during Urban Warrior, experimentation with commercial wireless equipment for intra squad communication led to the decision to acquire the ICON 14-channel unsecured radio as a interim intra-squad communications device for all active and reserve infantry battalions.

Other experimentation has led to two long-term programs to explore IT opportunities:

The Lab initiated through ONR what became the Extended Littoral Battlefield (ELB) ACTD for the specific purpose of developing the architecture to support experimentation into OTH communications. The intent was to explore the state of the shelf in supporting a network centric approach to distributing a common tactical picture across an extended littoral battlespace that inherently included both the land and sea echelons.

At the very beginning of *Hunter Warrior*, the Lab developed a concept and the

surrogate system to explore shipboard experimental command and control for the purpose of conducting seabased operations. The goal was to explore the implications of a digitized battlespace on command and coordination of an OMFTS/STOM operation. It included exploration of how to integrate many SACC, TACC, and TacLog functions. The Lab developed an Experimental Combat Operations Center (ECOC) using legacy and surrogate IT as a test bed to experiment with staff organizational concepts leveraging digital C2 systems that permit information distribution simultaneously throughout the staff and force.



### **Experimental Combat Operations Center (ECOC)**

The *Hunter Warrior* ECOC was originally intended to be a shipboard node of a network centric approach to organizing the future littoral battlefield around digital information. It was to be one of multiple nodes – not the hub – for decision-making within the naval task force during littoral operations. In the concept, similar ECOCs would be located on the various ships of the Amphibious Ready Group and the supporting Carrier Battle Group, and ashore

in mobile operations centers of the landing force.

The concept was based on a *vision* of the future battlefield in which information is digitally shared throughout the battlespace. Commanders at all levels could draw information from shared information data bases – similar in concept to Joint Forces Command's concept of a *Common Relevant Operational Picture* -- as required to provide situational awareness and to support their command and coordination requirements. Information would neither funnel up nor down a chain of command focused on filtering and interpreting information. Instead, information would be available near simultaneously to all echelons of command both on and off the battlefield.

The *Hunter Warrior* ECOC was intended to explore the implications of such a system on both staff organization and the types of decision-making systems that would permit distributing command and control functions within the battlespace. Most notably, the ECOC was intended to integrate the functions of the Landing Force Operations Center (LFOC) and the Tactical Logistics Group (TacLog) with Navy command and control functions such as the Supporting Arms Coordination Center (SACC) and Tactical Air Operations Center (TACC)

The Marine Corps Warfighting Laboratory developed a concept for a cellular staff organization to use the ECOC. The Staff was organized around functions. Fighting the current battle was the Engagement Coordination Cell (or section) that inherently combined all aspects of engagement – lethal fires, non-lethal fires, maneuver, psychological operations, etc. – into a single staff function.

The concept of the Engagement Coordination Cell was not dissimilar to that of the Effects Based Operations Cell currently under review by Joint Forces Command. Supporting the Engagement Coordination Cell was a Planning and Shaping Cell – similar to a Future Operations and Future Plans organization in function – and a Combat Information Cell that performed an information management function.

Notably, there was no intelligence fusion function. The experimental concept assumed that information technology would permit distribution of operationally critical intelligence information throughout the staff simultaneously to those individuals who needed it. A nascent intelligence fusion function was performed within the combat information cell and by a *red team* that provided an independent interpretation of the battle to the *battle captain* based on the perceived effects of events upon the enemy.

However, time and resources limited the development of the *Hunter Warrior C2* architecture to a single ECOC and the concept for experimentation during the AWE to that of funneling all available information to a single centralized decision making node within the ECOC. Although spectacularly successful in some aspects, centralization during the experiment led to a focus in subsequent ECOC development into improving the decision-making capability of the ECOC rather than the exploration of the impact of shared information within a network centric approach.

The *Hunter Warrior* ECOC demonstrated the value of electronic displays of information within an ECOC. However, the *Hunter Warrior* ECOC did not have an integrated C2 system. Instead, it was a

collection of stand alone legacy systems that were used in the AWE with various prototype systems such as *xBAIT* and the *3-Dimensional Workbench* (for visually displaying information) and *FEAT4* (for intelligent agent manipulation of data bases) that were on display but not actually used in the conduct of the experiment.

The *Urban Warrior* ECOC was a dramatic change in that it incorporated *intelligent computer agent* driven decision support systems. It was built around a prototype *Integrated Marine Multi-Agent Command and Control System* that was designed to employ computer agents in a variety of roles to aid in near-real time decision-making. Agent functionality provided similar *racking and stacking of information* capabilities that currently requires a host Marines with pen and paper – and grease pencils on overlays - - to accomplish. The approach was to use intelligent agents to make information more usable by decision makers rather than as a substitute for a Marine in the decision making loop. Agents provided limited support to distribution of information throughout the network – down to the squad level in some cases using a computer end user terminal – but fundamentally remained focused on providing decision support to the ECOC staff.

The *Capable Warrior* ECOC used during *Kernal Blitz (Experimental)* is a product improved *Urban Warrior* ECOC that has progressed primarily in its ability to incorporate legacy C2 systems with a wide band communications system. However, there has been significant improvement within its ability to support distributed decision-making and collaborative planning. Experiments have been conducted with distributed C2. For example, during one live fire experiment at 29 Palms fires were coordinated and then controlled using a

network centric approach by individual company Fire Support Teams using the same agent functionality available within the ECOC.

The ECOC is at a crossroads with *Kernal Blitz (Experimental)*. This is the final major systems demonstration for the ELB (ACTD). Already, some of the technology is under review for transition into the Unit Operations Center (UOC) program. Several others are candidates for further development by the Office of Naval Research. Upon completion of *Kernal Blitz*, the ECOC will become a test bed within the Lab to explore future C2 concepts and the potential impact of information technology such as shared databases and intelligent agent driven decision support systems within the Marine Corps.

### ***The Extended Littoral Battlespace, Advanced Concept Technologies Demonstration (ELB ACTD)***

During the June 2001 *Kernal Blitz (Experimental)*, the Lab and the ELB ACTD Program Office will conduct the third major experiment involving the ECOC. For this experiment, the ECOC is a state-of-the-shelf, high technology command center built from the bottom-up within an old magazine of the USS *Coronado*.

Following *Kernal Blitz (Experimental)*, the ELB ACTD will come to an end. EMPRS is the Army ATD that will potentially become an ACTD, under the management of the current ELB program management team, and continue the exploration of both the OTH communications waveforms and the collaborative decision making systems pioneered by the ELB ACTD. In addition, a number of specific technology subsystems are candidates to migrate into a number of other programs such as the UOC Acquisition

Program of MARCORSYSCOM and the Littoral FNC of ONR.

### ***Integrated Marine Corps Multi-Agent Command & Control System (IMMACCS)***

The CALPOLY IMMACCS program is leading edge, object oriented, intelligent agent C2 software. Along with the JPL Shared Net, NRL Stennis, SPAWAR MCSIT, the IMMACCS system architecture provides the tactical level model for command and control on the battlespace.



The Lab's Experimental COC design, with the integration of the IMMACCS system, has provided a prototypical operational and tactical level test bed to explore leading-edge technology for future experimentation. And, with the integration of the efforts and programs, leverages the technology, acquisition systems, and operational forces to ensure that the system supports the defined requirement.

The Lab will continue its initiative begun in April 2000 to transition certain IMMACCS components to MARCORSYSCOM in order to support the integration, data distribution, and data consistency of the separate MAGTF C4I Software Baseline (MSBL)

components in support of the development of the Unit Operations Center (UOC).

The Lab will continue to pursue agent-based IMMACCS development in order to assist in shaping the C2 decision support system of the future, and transition these capabilities when ready. Specifically, the Lab will apply intelligent agents in developing a laptop automated intelligence station in support of the infantry battalion Intelligence Officer. This laptop station will use the Battlespace Visualization Tool of IMMACCS and selected intelligent agents to permit management of the Battalion's reconnaissance, surveillance, and target acquisition (RSTA) capabilities

In addition, the Lab will continue to explore the use of intelligent agents in various decision support tools to include the ONR-funded SEAWAYS and LOGGY adaptive planning tools that permit near real time collaborative, adaptive planning and production of statements of logistic requirements, offload plans, and logistic support plans for multiple courses of action.

Finally, the Lab will continue to explore End User Terminal technologies, focusing on the squad leader and below, in order to assist MARCORSYSCOM in the exploration of technologies to bring the CTP to the lowest desirable tactical level.

From FY01-FY03, IMMACCS developers will, in conjunction with MARCORSYSCOM SE&I, modify Shared Net to function as a common database and data distribution engine in order to keep the data common and consistent among the three C<sup>2</sup> systems fielded at the Regiment and below: TCO, IAS, and AFATDS. Funding for this effort could largely come from FNCs.

Continue to experiment with elements of IMMACCS through FY03 focusing on enhancement of agent functionality at the EUT level, rather than at the MAGTF CE level. All experimental efforts must be linkable to operational requirements and have potential for transition.



The Following capabilities are targeted for delivery by June of 02:

- By 1 August 2001, complete assessment of the ECOC concept to include associated UNS, MNS, and recommended modifications to doctrine.
- Initial operator assessment of UOC concept and technologies to include TTPs. Prototype Shared Net database and data distribution system will be integrated into the MAGTF tactical C2 architecture, and transition to MARCORSYSCOM.
- Recommended UNS/MNS/ORDS for the C2 system after UOC based on experimentation with objectified, agent-based software in IMMACCS.
- Refinement of IMMACCS into an agent-based C2 experimentation platform for the *Beyond C2* Marine Corps Concept.

The desired end state is to develop a capability to synchronize data across legacy systems, and perform data distribution down to the platoon level. Targeted time frame for completion of capability is August 2003, with interim capability to be demonstrated during MC02. The MC02 interim capability will be integrated with the RSTA effort. Follow-on objective is to bring agent-based command and control technology to the Marine Corps.

## **End User Technologies (EUT)**

EUT development will concentrate on the foot mobile user at the company/battalion level and below, and EUT efforts will be transitioned to the maximum extent possible to the MARCORSYSCOM DACT project.

All developmental effort will be conducted in coordination with the DACT project, to ensure “buy-in” and enhance eventual transition and eventual fielding of technology enhancements.

EUT development will concentrate on the foot mobile user at the company/battalion level and below, and EUT efforts will be transitioned to the maximum extent possible to the MARCORSYSCOM DACT project. All developmental effort will be conducted in coordination with the DACT project, to ensure “buy-in” and enhance transition ability and eventual field ability of technologies.

The desired end state is to develop a candidate dismounted DACT system, and to provide the MARCORSYSCOM DACT project with operational feedback into alternative technologies and configurations sufficient to support informed COA decision-making.

## **Over-the-Horizon (OTH) Communications**

An UNS is presently in draft for an OTH battalion and below communications capability. The Lab is pursuing assessment of the MUBLCOM Low Earth Orbit satellite system as representative of the most promising alternative.

The alternative solutions to this requirement will be evaluated in a Course of Action selection led by MCCDC WDID; Lab’s MUBLCOM assessment will feed directly into this COA selection. Lab funding beyond FY01 is dependent upon acceptance by MCCDC WDID and determination of a supportable transition path.

The objective end state is to frame an alternative solution to the OTH communications requirement adequate to support future C2 requirements in support of both Marine Corps Expeditionary Maneuver Warfare Concept requirements and those of the emerging Joint operational concepts such as CROP, FLEEDO, and RDO using low earth orbit (LEO) or mid earth orbit (MEO) satellite constellations.

## **Infantry Company Communications**

The Lab will assess the tactical communications requirement within the infantry rifle company to determine the communications capabilities necessary to support emerging tactics, techniques, and procedures. Specifically, the Lab will explore candidates for an alternative to the SINCGARS radio and the unsecured Intra Squad Radio (ISR) to serve as a secure platoon tactical net.

The desired end state is a clear determination of the following:

- Is there a requirement for an intra-platoon radio?
- What is the best off the shelf solution, if the requirement exists?
- What logistical considerations, such as battery usage/recharging, must be taken into account?
- What are the manning implications?  
More 25xx/28xx required in the infantry battalion?

In addition, during FY01 – in support of Project Metropolis – the Lab will determine the most advantageous communications standards, protocols, frequencies, and waveforms to optimize reliable voice and data communications in an urban environment for the infantry battalion.

### **Enhancements to Airborne Command & Control**

The Lab and ONR funded an effort in FY00 to integrate the Army Airborne Command and Control System (A2C2S) into a UH-1 airframe, as a potential replacement for/enhancement to the ASC-26. This system designated the Marine Corps Airborne Command and Control System (MCAC2S), experienced limited success during assessment at WTI in October 2000. Based on the MCAC2S reassessment during the spring 2001 Weapons Training Instructor course or during KB (X), pursue one of the following three options:

- Conduct further experimentation by delivering one or more suites to the Operating Forces.
- Transition the MCAC2S to a MARCORSYSCOM program of record, such as CAC2S or UOC.
- Recommend MCCDC/HQMC Aviation initiate a program of record based on the existing MNS for the Marine Airborne Command and Control Console

(MACCC to be funded in POM 04. Pursue interim R&D funding through FNCs to mature the system design and functionality, so that when MARCORSYSCOM establishes the program of record, it will be ready for Milestone III decision by the end of FY04.

### **MCTSSA Systems Environment Lab (SEI Lab)**

The Marine Corps Tactical Systems Support Agency (MCTSSA), located at Camp Pendleton, has established an SEI LAB designed to integrate systems as they are completed, but before they are fielded to the Fleet, and ensure they integrate properly into the existing operational system COC.

The MARCORSYSCOM Unit Operations Center (UOC) Program that is designing the tactical and operational shelters and associated systems for the operational forces of the future will conduct initial operational configuration tests within the SEI Lab as well as with I MEF units.

### **Joint Intelligence Surveillance Reconnaissance (JISR) ACTD**

The JISR ACTD is an Army sponsored program that fuses the intelligence pictures in the operational and tactical level operation centers. The program has been seeking Marine Corps operational input and is currently funding an on site representative at I MEF -- within the Lab's liaison office -- to coordinate access by the program office with I MEF and the Lab.

## RECONNAISSANCE, SURVEILLANCE, TARGETING ACQUISITION (RSTA)

### Background

The concept of Maneuver Warfare is based on the ability to identify gaps and surfaces in the enemy defenses where combat power can be applied. Likewise, the Marine Corps concepts of Operational Maneuver From the Sea (OMFTS) and (Ship-to-Objective Maneuver (STOM) are inherently based on our ability to identify where, when, and how to maneuver our combat power ashore to accomplish decisive results. The common enabling capability in each is our ability to develop timely intelligence about the enemy that enables decisive maneuver and the application of combat force.

The Department of Defense is developing a robust Joint technological capability to collect intelligence at the theater level while the Navy is developing operational intelligence capabilities through Naval Expeditionary Sensor Grid. Both efforts intend to support theater – operational level – intelligence collection in three categories:

**Reconnaissance** – the active collection of information within a specific battlespace area of interest, generally through the use of remote collection means such as combat forces and/or sensors.

**Surveillance** – the passive collection of information about a specific area of interest through the use of a passive information collection system.

**Target Acquisition** – collection of information about a specific area with a level of specificity intended to allow for engagement by weapons.

Collectively, these capabilities are referred to by the acronym RSTA. From the perspective of the Marine Corps, RSTA refers to *Tactical RSTA* capabilities performed by Marine Corps forces in support of the MAGTF.

**RSTA Grid** – The term *grid* describes the physical placement of sensor mechanisms or network. A network of sensors, cameras, recon teams, and infantry units established to provide reconnaissance, surveillance, and target acquisition for a prescribed area. Given that RSTA assets are warfighting/intelligence gathering resources, the planning for and establishment of the RSTA grid must be linked to the Intelligence Preparation of the Battlefield (IPB) process. The intelligence collection plan, in support of the CCIRs and IPB process, will be the major factor in determining how to employ/allocate RSTA assets. The locations of ground-based sensors will correspond to those areas having significant interest to the commander (NAI/TAI/DP). The grid is an integrated collection of RSTA assets positioned at various locations on the battlefield. The grid will require constant validation and reallocation of assets due to the dynamic nature of the battlefield.

### The Problem

The Commandant's Planning Guidance (disseminated in 1999) specified that an issue for the Marine Corps was the correction of deficiencies noted in ground reconnaissance.

This conclusion was consistent with the findings of the Lab's funded experiment with III MEF that implemented the Ship-to-Objective Maneuver (STOM) concept. During that experiment the Lab found that there were insufficient reconnaissance assets to conduct tactical operations using maneuver warfare principles. To increase the number of

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these assets would require a substantial investment in resources and manpower. Low survivability of reconnaissance units in future operations was also perceived as a contributing factor to this deficiency.

Additionally, current reconnaissance, surveillance, and targeting systems do not provide tactical commanders at the squad through regimental levels with consistent, reliable, and real-time information pertaining to the enemy. Overall, commanders require a system that provides improved battlefield awareness.

**Focus on Infantry Battalion** --Our initial effort for tactical RSTA is at the battalion level with focus on the urban environment; the intent is to present a construct that integrates the information collection/intelligence development process with currently available technologies to assist in targeting and fires. The RSTA concept provides a method to improve situational awareness for battalion decision makers and permits more rapid engagement decisions based upon increased knowledge of the enemy within the battalion's area of interest.

The following planning assumptions are mandated in designing a RSTA prototype capability for the infantry battalion:

- No increase in the number of personnel in current tables of organization for the Operating Forces.
- There is no formal training that will necessitate increases in T2P2; however, OJT will be necessary.
- No additional transport or power requirements will be levied on the Battalion.

Where possible, current off-the-shelf technologies are to be applied to the tactical

RSTA problem at the infantry battalion and below and result in a demonstrable increase in force protection and offensive capability.

*By 2002*, the Lab will develop a usable prototype tactical Unmanned Aerial Vehicle (UAV), a Unmanned Ground Sensor (UGS), a Unmanned Ground Vehicle (UGV) and a initial Battlefield Visualization Tool (BVT) that infantry units at the tactical level can employ. The intent is to produce a RSTA capability in a phased approach that can be expanded in subsequent years to provide a larger, integrated RSTA capability within the MAGTF as a whole.

The RSTA system at the battalion level can be defined as a wireless, agent-based, mobile network of sensors with versatile delivery systems, that can combine with organic maneuver units/patrols to collect, process, disseminate, and display near real-time reconnaissance, surveillance, and targeting information within all dimensions of the battlespace (air, ground, water) relevant to the battalion's area of interest. Ultimately, the system will have the means to integrate with the electronic common tactical picture (CTP). This system is intended to produce an integrating tool for battalion staffs to enhance its cumulative organic reconnaissance capabilities.

Maneuver units can gain both increased combat capabilities and force protection value from the adoption of mobile (robotic/airborne) sensors used to see over the next hill or building (urban terrain). The ability to maintain surveillance/conduct reconnaissance over a key avenue of approach for extended periods of time, in lieu of or in augmentation of manned units, is essential. At the infantry battalion and below, the current primary RSTA assets are the individual/collective infantry units and the Surveillance and Target

Acquisition Platoons. Their contacts and observations of the enemy are the primary sources of situational awareness for unit commanders. Unit sightings are augmented by information collected by the Scout Sniper platoon and information disseminated to the battalion from higher and adjacent units. There is currently limited application of technology to connect the disparate parts of the battalion's RSTA assets together into an integrated system.

The envisioned RSTA system augments current capabilities into a single viewing system. Using a systems approach, these enhanced capabilities will be the building blocks of an integrated RSTA system to be used to integrate the battalion's RSTA assets into a CTP. This will lead to a MAGTF RSTA system capable of integrating into the Navy's Expeditionary Sensor Grid.

This RSTA Grid will provide the means to maintain improved situational awareness and optimize the effectiveness of the decision making cycle by using an agent based fusion system. Information collected/processed will provide intelligence concerning enemy unit identification, location, strength, and direction/speed of advance. Alerts will be built into the system to provide early warning to users that certain events, selected by the user, are happening.

Such versatility provides the commander full control of his RSTA assets for information collection and intelligence dissemination and allows for the rapid re-tasking of RSTA assets to account for the dynamic nature of the battlefield.

## Components of the RSTA Grid

**RSTA Sensors** – In this focus area the emphasis during experimentation is related to integrated, multifunctional, and

modular/mobile sensors. Sensors will include both fixed, as well as air and ground mobile

chassis. In addition, the Grid will incorporate EO, IR, SAR, COMINT, ELINT, MASINT, and HUMINT. Experiments will assess the operational usefulness of the sensors/systems and develop TTPs to maximize their tactical contribution. Reducing the size of the sensors will be a goal in order to reduce package weight and enemy detection. Additionally, smaller sensors will increase the capability/maneuverability of the delivery vehicle. Nano-technology and new alternate power sources (battery, solar, fuel cell, etc.) will be explored. Tactical RSTA sets, designed as an integrated/deployable package, will provide an enhanced capability.

**RSTA Sensor Delivery/Maneuver** – In this focus area the emphasis during experimentation concerns the insertion means (air dropped, indirect fire released, hand emplaced) and air or ground vehicles/chassis used to deliver and maneuver the sensor on the battlefield. Reducing the size of the vehicles is essential to reduce package weight and likelihood of enemy detection. System capabilities must allow for rapid relocation to accommodate changes created by a dynamic threat. Air-borne vehicles must have the capability to loiter about an area for an extended period. Additionally, the Lab will explore new power sources for these vehicles.

**RSTA Information Display** – The emphasis during experimentation is on developing a versatile agent-based system that collates the information gathered by the RSTA assets and displays it in a format that the commander and his staff can use. The agent-based system will subsequently disseminate information across the RSTA Grid once there is a data transmission capability within the units. Once a web-based communications system that supports a CTP is available to the operating

units, the RSTA information display should be an integral part of the system's sensor-to-shooter capability. This will include employment of a jam-resistant universal call for fire system. To fit within the OMFTS/STOM construct, it must eventually be connected to the MAGTF's OTH C2 network.

**System Connectivity** – The tactical RSTA systems/network will use existing tactical communications or a single stand-alone system capable of employing frequencies and standardized protocols available to the US military both within the US and overseas operating areas. The RSTA system will have the flexibility to be incorporated into proposed wireless CTP OTH networks. Widely dispersed forces in a highly mobile and asymmetric environment will demand a reliable, flexible, and responsive system. Forces and sensors must be able to acquire targets and call for immediate fire support. The system must allow for a sensor relocation capability without interrupting connectivity.

Furthermore, the RSTA wireless sensor-to-shooter capability will allow the commander to immediately address critical and time critical targets as they appear, thus increasing the tempo of combat. Such a capability will enhance the ability to decisively and aggressively execute operations, create gaps in enemy defenses, and effectively shape the battlefield.

Connectivity will focus initially on line-of-sight to ensure deliverability of a system that is usable with current tactical communications equipment. Frequencies and protocols should be standardized to permit a building block approach to the eventual adoption of emerging communications architectures.

The purpose of this concept is twofold: Reduce the weight of the combat load carried by Marine Recon / STA Teams, and to enhance their capabilities to collect and disseminate gathered information to the proper level. The concept involves Commercial-off-the-shelf (COTS) / Government-off-the-shelf (GOTS) equipment to include: wireless day/night camera systems, tactical day/night digital video/still camera systems, remote observation and confirming sensors, ruggedized handheld computers, stabilized binoculars, GPS watches and other new technology advances that enable the Marine to collect information more accurately, increase stand-off ranges, move lighter, and report faster.

New communication assets include multi-band radio-transmitters such as the AN/PRC-117F. The AN/PRC-117F is one radio-transmitter that contains three frequency bands: UHF, VHF, and SATCOM. Thus, the AN/PRC-117F is one radio-transmitter with the capability of three radios.

Additionally, lightweight sensors will be added to the Recon Teams mission package. The sensors will provide indications and warnings of the approaches to the teams surveillance positions and hide-sites.

### Equipping the Reconnaissance Marine

## ASYMMETRIC STRATEGIES

### Center for Emerging Threats and Opportunities (CETO)

CETO is a partnership between the Marine Corps Warfighting Lab and the Potomac Institute dedicated to exploring innovative ways to deal with increasingly complex and non-traditional threats to the national security.

Future global challenges will be increasingly complex and less likely to be solved by overwhelming force, requiring timely and effective approaches across the full range of military operations, and including governmental and private civilian inputs.



CETO was established at the direction of the Senate Sub-Committee on Emerging Threats and Capabilities out of a growing concern for the wide range of security challenges the U.S. will face in the 21<sup>st</sup> century.

The center's unique approach aims to facilitate cooperation between the military and other public and private agencies, including the State Department, non-governmental, volunteer, and academic organizations. The objective of the center is to transform its

research into operating force capabilities needed by both Marine Corps and joint warfighters for small-scale operations around the world.

The center employs experts and scholars to research subjects ranging from non-lethal weapons policy to robotics and homeland defense. Senior advisors include: General Alfred Gray, former Commandant of the Marine Corps and Ambassador Robert Oakley, former ambassador to Zaire, Somalia and Pakistan, and special envoy to Somalia. Jerry Hauer -- former director of the Mayor's Office of Emergency Management of New York City -- is a consulting fellow on homeland defense issues.

A special focus of the center's research is on technology in order to identify technology solutions to capability shortfalls. Research, analysis, and assessment are conducted through a program of workshops, seminars, and simulated wargames, and the results are submitted to the Marine Corps Combat Development System for potential transformation into operational products.

An ongoing objective is the support of selected operating needs of the forces, including planning, decision, execution, assessment, and training.

The center attempts to solve the problems identified as lessons to be learned from non-traditional military operations conducted since the end of the Cold War. It has assumed responsibility for:

- Emerald Express Lessons Learned Conferences
- Cultural Intelligence Seminar Series
- Marine Corps Operations Other Than War (OOTW) website.

## CETO Projects

Project	Manager
Advanced Technology Search	Mr. Hansen
Army/Marine Corps Asymmetric Working Group	Mr. Worley
Asymmetric OPFOR (JFCOM UV 01/MC 02)	Mr. Anderson
CBIRF 911 System	Ms. Graham
Deployable Support Teams	Mr. Borchini
Joint Red Team (JAWP/RDO)	Mr. Anderson
Naval Force Protection	Mr. Adams
Non-Lethal Weapons Policy	Ms. Graham
Shipboard Security	Mr. Adams
Project Lincolnia II	Mr. Hammon
Situation Awareness	Ms. Graham
Small Wars Manual	Mr. Sinnott
Strategic Assessment South Asia	Mr. Peters

### Asymmetric Approaches Working Group

Develop and prepare a recommended Joint approach to prepare, train, and equip Joint/Combined forces to counter asymmetry for the Army and Marine Corps Warfighter Conference.

### CBIRF “911” Policy

Develop a Chemical Biological Incident Response Force (CBIRF) 911 system to improve the ability of first responders – typically local fire departments and emergency agencies -- to coordinate directly with the CBIRF in the event of a CB incident.

### CETO Deployed Support Team

Provide operational support to Marine and Naval forces. Primary focus is to be prepared to assist deploying MEUs upon request to prepare for and execute non-traditional operations. Predeployment assistance (training, cultural intelligence and technical advice), contingency support via reachback, and deployment of specific support team members are examples of support provided at the request of operational forces.

The objective is the coordination of timely and tailored training and deployment assistance in the use of specific skill sets and capabilities not normally available or organic to them, including psychological operations, civil affairs, coordination with Non-Governmental Organizations, Private Volunteer Organizations, and Independent Organizations (e.g., World Food Foundation Programme Medecans Sans Frontiers, Catholic Relief Services, etc.), and the use of diplomacy.

Special attention is placed on the coordination of interagency, NGO community, Army PSYOP and Civil Affairs forces, and other regional experts who have first hand experience and knowledge and can provide broad perspectives and address specific issues on a country or region. Additionally, CETO has coordinated with the Army Military Police School to provide training in topics such as pattern and link analysis, negotiations and checkpoint operations.

### Small Wars

Based on operating force requirements and lessons learned from Small Wars conferences and cultural intelligence seminars CETO is prepared to coordinate – upon request -- a tailored, non-traditional operations pre-deployment training package for deploying MEUs. The CETO Support Team can provide contingency assistance as required and training provided in conjunction with each requesting MEU’s deployment schedule.

### Joint Forces Command/Joint Advanced Warfighting Project Red Team

CETO provides subject matter experts to represent alternative opposition forces that are intent to practice asymmetric strategies against the US and its operating forces during wargames, exercises, and concept-based

experiments. Specifically, CETO is providing Red Team member support in JFCOM J9 sponsored wargames and seminars and in providing the counter force for the JAWP in assessing their new concepts for future power projection.

### Naval Force Protection

In the wake of the Cole incident, the Navy has embarked on a concerted effort to implement innovative ship force protection technologies and procedures. ONR has funded CETO to conduct experiments and assessment of current ship defense capabilities to counter non-traditional threats and provide recommendations to improve current capability. Deliverable product(s) of this effort include technology, training, tactics, techniques, and procedural recommendations to improve naval force protection.

### Non Lethal Weapons Policy

Assist the Joint Non Lethal Weapons Directorate and OSD in developing policy in NLW employment, which will allow employment of directed energy non-lethal weapons. The proposed policy and concept for implementation will be developed using a series of conferences to craft policy recommendations to present to OSD as well as a program of wargames, seminars, and conferences to prepare decision makers as to the political, legal, and issues related to the future employment of directed energy non-lethal technologies.

### Small Wars Manual

The current Marine Corps *Small Wars Manual* has not been updated with current procedures and tactics in over 50 years. At the request of the Commanding General, Marine Corps Warfighting Lab, CETO is embarked in updating this seminal work with

the results of new technologies and concepts with the goal of producing an updated *Small Wars Manual* as a guide for the Marine Corps in conducting Military Operations Other than War. The new draft will be the result of a series of conferences that will be conducted to obtain input from operating forces and non-military experts and the manual will be updated based on this input. Upon completion, the draft will be routed for comment within the Marine Corps to determine its future utility as an officially sanctioned doctrinal publication.

### Strategic Assessment: South Asia

South Asia is the single most dynamic region of the world and one that is almost guaranteed to be the nexus of future conflicts. The CETO-sponsored strategic assessment is aimed at a non-traditional assessment of the region, the potential for asymmetric threats to US interests to emerge in the region, and the types of hedging actions that the US – and specifically the Marine Corps – can take to prepare for employment in conflicts within the region.

### Advanced Technologies – Mobile Ground Sensors

Future warfighting concepts typically require approximately five times the force reconnaissance assets that a Marine Corps Air-Ground Task Force (MAGTF) can muster today. CETO is assessing whether very small UGVs can effectively augment our reconnaissance capability.

*Experimental Objective* -- Emplace at least thirty of these systems on the ground in places where human recon teams might not be survivable. Each robot would have the ability to do what a human team can do, but its operators would be safely aboard ship or in an

airplane. This includes the capability to call in highly accurate fire missions.

*Air Insertion* -- Insertion of these robots by a UAV is a desired capability.

*Sensor capabilities* -- (1) Day camera (2) FLIR (3) FO/FAC call for fire and target designation capability, and (4) audio sensor.

*Timeline* -- the goal is to have a contingency capability of at least thirty systems available for operational assessment by 2002 with programmatic transition to a MARCORSYSCOM Program of Record by 2003.

### **Gender-Specific Human Intelligence Collection**

Historically, the US military has used men almost exclusively to interrogate and collect human intelligence. However, in some cultures specifically -- and with women and children in most cultures -- women may have greater success in collecting valuable intelligence information. At the direction of the Commanding General, Marine Corps Warfighting Lab, CETO will assess the potential benefits of a concerted effort for gender-specific human intelligence collection capability within the Marine Corps.

### **Project Lincolnia**

Project Lincolnia is a series of multi-level war games, conducted by the Potomac Institute for Policy Studies, the National Defense University (NDU), and the Lab.

Historically, most urban warfare experimentation within Department of Defense was done only at the tactical level. Lincolnia uniquely represents the implementation of a process, in which the objectives of a political-military plan drive

negotiations in a strategic level wargame, bound the joint planning at the operational level, and attempts to implement those plans at the tactical level. The GAO in their report *Military Capabilities: Focused Attention Needed to Prepare U.S. Forces for Combat in Urban Areas*, NSIAD-00-63NI, encouraged this process. February 25, 2000

Project Lincolnia has two major objectives:

- Address the General Accounting Office's recommendations to expand the Department of Defense urban warfare experimentation beyond the tactical level, and
- Gather data on any effects of advanced technologies on friendly and non-combatant casualties in an urban warfare environment.

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## MILITARY OPERATIONS IN URBAN TERRAIN (MOUT)

**Purpose:** To solve critical warfighting issues related to conducting MOUT in support of *the 2001 Ground Combat Element Campaign Plan* in preparing Marines for the uniquely physical nature of combat and likewise, to take appropriate action in any terrain or environment and at any time.

**Hypothesis:** *That properly trained and equipped MAGTFs can successfully operate in the urban battlespace, while incurring lower than historically expected casualty rates.*



**Program Description:** Project Metropolis (ProMet) is the umbrella project for MOUT experimentation. Experimentation conducted under Pro Met charter will result in both the recommended TTPs for the operating forces and the majority of the experience needed to identify technologies and equipment enhancements for the operating forces. The project is a continuation of urban warfighting experimentation begun during the *Urban Warrior* experimentation series. The project built on the two key lessons learned during *Urban Warrior*:

- That the majority of problems can be resolved with better training, and
- That units must employ combined arms teams to be effective.

Based on these two fundamental points,



ProMet focused in Increment One and Two on developing tactics, techniques, and procedures (TTPs) to enable Marines to fight and win in the *Block 3* MOUT environment, while reducing casualties from the historical 30-40% to 20% or less. As these TTPs were developed, they were incorporated into a comprehensive urban warfighting training package that was forwarded to Training and Education Command (TECOM) in December of '00.

During Increment Three, ProMet has changed its focus into addressing the challenges of *Blocks 1 and 2*, urban rotary wing operations, and urban ground reconnaissance. In conjunction with developing the TTPs and their associated training lessons, ProMet is evaluating the value of selected technologies.

The project began in June of 1999 and is projected to continue through 2002. The specific objectives for the project are:

- Develop urban warfighting TTPs.
- Validate TTPs through experimentation at the squad, platoon, company and MAGTF combined-arms levels.
- Draft a comprehensive MOUT curriculum for hand-off to TECOM after determining the *right* things to teach and the best way to teach them

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- Determine the training time required to achieve individual and unit *proficiency* to win in the urban battlespace and reduce casualties.
- Determine required training frequency to maintain individual and unit proficiency.
- Determine the relative value of selected technologies.
- Develop recommendations for improvements to existing MOUT facilities



**Project Rifleman** -- To identify technology and equipment solutions to combat perceived deficiencies in the infantry squad. The Lab is the intended experimental test-bed for MARCORSYSCOM's *Integrated Infantry Combat System* (IICS) program closely coordinated with MCCDC's *Marine Enhancement Program* (MEP). The IICS was given Acquisition Category IV (ACAT IV) designation on 18 June 1998 with a Request for Alternative Analysis approved in January of 1999. The IICS is *a concept for equipping the rifleman for the 21<sup>st</sup> century* as stated during the 2 June 1999 Kickoff Conference. The IICS program is currently in the concept development phase.

Specifically, the utility of the following technologies will be assessed within Project Rifleman:

- Lightweight, high resolution, handheld thermal imager.
- SPECTRA fabric Load Bearing Equipment, single-wall shelter, lightweight MACK equipment
- Flame-retardant base-layer [NOMEX fleece, replaces easily melted/flammable poly-pro].
- Autonomous handheld navigation/communication/tracking system [AGNC Corporation, US Navy SBIR N00-024]
- MBITR multi-band radio
- Generation II MICH helmet [Natick-designed integrated comm. headset.
- Advanced Tactical Concealment.
- M4 MWS [with laser holographic reflex optic, suppressor, & shotgun].
- Thermal Flash Beacon [from Crane NAVSPECWAR effort, invisible to NVG].

Detailed assessment report as to the impact of the technologies on existing TTP's, and recommendations/conclusions on how best to conduct further Marine Corps assessment of these technologies. The intent of this assessment report is to reveal the findings of the experimentation and prove or disprove the original hypotheses. The impetus gained in these initial experiments will generate further experimentation/ assessment with the technologies in order to provide the Marine Infantry Squad with enhanced lethality, mobility, survivability, and C2.



## EXPERIMENTATION CAMPAIGN PLAN -- 2001

16 June 2001

**Land Warrior Assessment** -- To observe and record initial data (*First Look* for the Marine Corps) regarding the US Army's Land Warrior, a lightweight, integrated, and wearable combat system for the individual rifleman / squad. The goal of this system is to achieve a significant overmatch (versus enemy) in the areas of situational awareness, lethality, survivability, mobility, and sustainability.

**MOUT Advanced Concept Technology Demonstration (ACTD)** – The MOUT ACTD was initiated in October 1997 as a joint Army/Marine Corps program with Special Operations Command as the Joint sponsor. Along with the Army's Dismounted Battlespace Battle Lab, the Lab served as co-operational manager.

The objective was to improve the operational effectiveness of soldiers and Marines operating in urban areas through the integration of advanced technologies and associated tactics, techniques and procedures. of the ACTD was to find the most useful technology that can be combined with TTPs to produce improved capabilities at the infantry battalion and below.

Ten separate Service squad or platoon level experiments were conducted involving 128 technologies during the period from January 1998 to May 1999. A company level experiment was conducted in July 1999 and a battalion level culminating experiment was conducted in September 1999.

The most promising technologies and equipment are currently under extended user evaluation by the 2d Marine Division as a deployable urban kit.

The Lab has been involved in redefining the equipment needs of a unit based on the results of both the MOUT ACTD and ProMet experiments. Accordingly, a follow-on

Vanguard advanced technology demonstration is under consideration – potentially in conjunction with Special Operations Command- sponsored Pathfinder ACTD to start in 2003.



### Urban Ground Reconnaissance

The capability to conduct tactical urban ground reconnaissance within the Marine Corps is currently non-existent. This lack of capability, coupled with the limited capability of overhead systems, sensors, etc. to work effectively in urban areas, force commanders to operate virtually “blind” in an urban environment.

Although some CIT capability does exist, it is very limited, and may well prove ineffective in a fast-paced mid-intensity conflict. This type of capability is more effective at the *blocks one and two* of urban operations. To operate more effectively, Marine Divisions should possess the organic capability to conduct reconnaissance in order to give Commanders some intelligence of enemy and the terrain in the assigned area of operations.

Outlined below is a macro-plan for development of an urban ground reconnaissance capability for organic units of the Marine Corps. The plan seeks to develop

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and test the tactics, techniques, procedures and supporting technologies to enhance current reconnaissance and surveillance and target acquisition capabilities. The plan envisions an effort that is funded and coordinated by the Lab and executed by 1<sup>st</sup> and 2<sup>nd</sup> Reconnaissance Battalions, and 1<sup>st</sup> and 4<sup>th</sup> Force Reconnaissance Companies.

Each of the units will take a different element of the urban ground reconnaissance requirement. First Force Reconnaissance Company will develop the TTP for the conduct of transition from rural reconnaissance to urban terrain. First Reconnaissance Battalion will develop the post H-hour requirements, 2d Reconnaissance Battalion will develop pre H-hour TTPs, and 4<sup>th</sup> Force Reconnaissance Company will develop the requirements for recon units operating in support of peace keeping and peace support operations.

The Urban Ground Reconnaissance effort is planned as a two-year evolution, with results obtained by May 2002 to be evaluated during Millennium Challenge 02 Advanced Warfighting Experiment. RAND Corporation has been contracted to support this effort, to include proposal of advanced TTPs, evaluation of results of unit efforts, and evaluation of experiments conducted.

### Rotary Wing Operations

Conducting rotary wing operations in support of urban operations was identified during Urban Warrior. Marine Aviation Weapons and Tactics Squadron One (MAWTS) at MCAS Yuma has collaborated with the Lab in the conduct of urban close air support studies and the examination of TTPs for improved aviation survivability during urban operations. The Lab conducted limited experimentation with rotary wing aviation during the battalion level phase of Project Metropolis. Based on

the results of this limited experimentation, the Lab will continue efforts, in conjunction with MAWTS and the US Army TF 160 to develop advanced TTPs for rotary wing operations in the urban environment.

Working in conjunction with MAWTS, the Lab will conduct an evaluation of the M3M open bolt, pintle-mounted medium machine gun system. This stabilized weapon system, which has a laser range finder and reflex sight for enhanced probability of first round hit on target and sustained rounds on target. The M3M system will be evaluated on three types of aircraft, the CH-46, CH-53E, and the UH-1N. Following initial evaluation at MAWTS, further operational assessment will be conducted with deploying MEUs.

### Training and Experimentation Facilities

Yodaville – ONR and the Lab funded the development of an Urban Close Air Support facility located near Yuma Marine Corps Air Station. Operated by Marine Aviation Weapons Training Squadron-1, this is the only facility in the world designed specifically to support live fire close air support experimentation and training.



Camp Lejeune Breaching and Shooting Houses – Constructed by the Lab in support of the MOUT ACTD, these facilities continue

## EXPERIMENTATION CAMPAIGN PLAN -- 2001

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to support both Lab experimentation and tactical training of East Coast Marines.



coordination with the GCE Advocate intended to enhance the combat capability of the reinforced infantry battalion. These follow-on experiments will build on experimentation to date that point to a potential transformation of infantry operations based on improvements in information networks as well as selected technology insertions.

Desolate City – The Lab has contracted for a temporary Urban Training Facility of approximately 720 former family housing units of condemned family housing within the former George AFB near Victorville, CA. This Urban Training Facility *Desolate City* is currently under review for possible lease as a interim facility available to support urban training and experimentation through summer of 2002.



Project Metropolis will continue through 2002 to develop an Urban Combined Arms Exercise (UCAX) prototype training exercise as well as further small unit experiments in

## LOGISTICS SUPPORTING FOCUS AREA

### Background

The Marine Corps has not been isolated from a sustainment base or distribution channel for thirty or more consecutive days since Guadalcanal. Yet, we continue to foster an “iron mountain” approach to sustainment and accompanying supplies with a corresponding distribution bottleneck to logistics support.

This approach creates an exploitable vulnerability both in the rear area and the vital distribution routes, creates a brake on operational tempo, and is counter to our future concepts for Enabling Expeditionary Logistics. There are a number of efforts designed to improve logistics at the national and theater levels, and within the Marine Corps Enabling *Expeditionary Logistics Concept* and the 1 January 2000 *USMC Logistics Plan*.

### The Legacy -- *CSS Enterprise*

From the beginning of the Warrior Series of experiments, the Lab has supported Combat Service Support experimentation initiatives. The Lab’s CSS focus has followed three experimentation paths simultaneously.

The primary path has been that of supporting an operational Force Service Support Group (FSSG) in applying current state-of-the shelf technologies to new organizational approaches to supporting the ground combat element in widely dispersed maneuver operations.

Beginning with 1<sup>st</sup> FSSG during *Hunter Warrior*, the Lab provided limited funding support for the establishment of an

experimental Combat Service Support Element (CSSE) organized around information technologies under the title of *CSS Enterprise*.

During *Urban Warrior 2<sup>nd</sup>* FSSG followed a similar path in organizing an experimental CSSE as *CSS Enterprise—the Next Generation* with a similar goal tailored for the urban environment. These two efforts led directly to a number of CSS initiatives, one of which was the Small Unit Logistics Advanced Concept Technology Demonstration.

The second major approach was the pursuit of organizational concepts and the development of tactics, techniques, and procedures (TTPs) for small unit logistics support in the close battle – specifically the urban battlefield – but with implications to the tactical support of ground combat elements in general

The third effort is the operational evaluation of new technologies and prototypical equipment with the operating forces in support of ONR FNCs and MARCORSYSCOM program managers. Operator assessment has proven to be a successful method of assisting in determining operational priorities for systems acquisition and in developing operational procedures for implementing new technologies by the operating forces.

**Organizational Approach** – The Lab generally supports a customer in organizing operational experimentation with new technologies and organizations. Typical CSS initiatives are evaluated in LTAs or introduced into the operating forces for sustained operator assessment leading to incorporation into a major Marine Corps or Joint experiment in which the CSS initiative supports an experimental concept.

## Joint High Speed Vessel

The Lab has the lead for the Marine Corps in coordinating and executing an experimentation effort with the Joint High Speed Vessel prototype. This vessel is tentatively available for experimentation during FY2002 and presents a potential opportunity for the exploration of alternative logistics support concepts for intra theater delivery of selected equipment and logistics in the conduct of future expeditionary operations, and as an alternative to the Amphibious Follow-on Echelon for an amphibious expeditionary operation.

Experimentation with the JHSV may take a number of forms to include use by an operating force in a scheduled exercise or as part of a joint experiment such as Millennium Challenge 2002. Regardless, experimentation with such a platform will likely lead to experimentation with other technologies that either complement or supplement existing initiatives such as SWING THRU for the self contained loading and unloading of containers on to trailers – or automated inventory technologies as part of the implementation of the Integrated Logistics Concept or application of Small Unit Logistics technologies.

## Delivery Systems

During *Hunter Warrior* the Lab experimented with a number of remote delivery means to include Powered Parafoils, GPS-Guided Gliders, and Guided Parafoil Air Delivery Systems (GPADS). The objective was to identify a means to reliably deliver operationally significant logistics support to dispersed operational forces with reduced risk of detection of the ground force and to manned aircraft.

During Urban Warrior, the Lab expanded this experimentation effort to address unmanned surface craft – SeaDoos – and unmanned helicopters – BURRO. In both cases, the objective has been to provide alternatives to manned aircraft.

In addition, the Lab has pioneered in experimentation with alternative ground vehicles for the purpose of supporting the infantry battalion in urban combat. Alternative vehicles to the current HMMWV standard infantry vehicle are under review that combine greater agility in rubble and confined urban spaces and reduced susceptibility to ground fire for the specific purpose of providing tactical logistics delivery and casualty evacuation in close terrain.

By 2002, the Lab will complete assessment (with associated modifications to UNS/MNS/ORDs) of experimental delivery platforms (BURRO, GPADS, Unmanned Powered Parafoil and an urban logistics vehicle, et al). In addition, the Lab will develop the TTPs for effective unit distribution of sustainment within MOUT environment/scenario.

## Ground Logistics Command and Control (GLC2)

At the heart of the GLC2 initiative was the multi-agency development of the Small Unit Logistics under its Advanced Concept Technology Demonstration (SUL ACTD). This system is an interoperable tactical level logistics command and control software system using open systems architecture. It provides the flexibility to allow continued access to data and information resident in the myriad of legacy applications, databases, and other systems currently used in the military logistics community. The system

provides data in a coherent manner to the user even though it may have originated from physically separated heterogeneous databases.

The SUL ACTD was built upon the technologies and the experience of CSS *Enterprise* during *Hunter Warrior*. Subsequently, the Lab has actively supported experimentation with SUL technologies and will assist the CSSE Advocate in incorporating SUL C2 capabilities into existing and future command centers.

The next step in the GLC2 evolution is incorporating sensor technology into existing equipment and supplies in order to achieve total asset visibility (TAV) of those items, logistically. Embedded vehicle diagnostics, linked to a communications architecture -- that permit remote monitoring of the vehicle's *vital signs* -- is a vital requirement for predictive maintenance, linked to TAV, and is the current revolution away from phased maintenance. The concept has been pioneered commercially by Caterpillar Tractor and is currently programmed into the AAV.

In coordination with the Logistics Advocate and through the implementation of the Integrated Logistics Concept and sensor technology development, the Lab will assist in refining the requirement for autonomic logistics/ predictive maintenance capability in future, major end items.

In addition, the Lab will assist the CSSE Advocate in completing UNS/MNS/ORDs as to the need for predictive logistics decision support systems.

## Modeling and Simulation Tools

The Marine Corps needs computer tools to permit near real time course of action analysis and computer assisted tracking of changes in logistics databases. Both the Joint and Service future operational concepts are based on the integration of the theater logistics inventory, the sea echelons logistics capability, and the MAGTF's requirements, into a single logistics picture that can support distributed, collaborative planning and execution.

A means to coordinate and monitor the actions on-going in all three distinct, simultaneous cycles -- theater inventory, the requirements of the MAGTF, and the planning cycle of the naval task force -- is essential to near real time course of action assessment and adaptive planning.

These tools are the next step in providing the decision support systems necessary to integrate operations and logistics such that the decision making process can support rapid, decisive planning, and execution of complex schemes of maneuver on a widely dispersed future battlespace.

The Lab is actively supporting ONR and the CSSE Advocate in experimenting with decision support systems that enable adaptive planning and execution. For example, the Lab is specifically supporting ONR -- in partnership with the Naval Warfighting Doctrine Command -- conducting a LOE involving an intelligent agent prototype decision support system funded by ONR called SEAWAY and a companion ONR funded MAGTF proof of concept system called LOGGY during November of 2001.

The assumption is that SEAWAY/LOGGY is a potential means to provide an initial intelligent agent driven decision support capability in a MAGTF logistic C2 tool

chest. SEAWAY version 1.0 -- with a limited LOGGY element to permit employment of MAGTF data bases -- will be installed in Ellis Hall at Quantico following the November 2001 LOE. It is gaming of this version of the SEAWAY logistic C2 package that is intended to assist the Lab (and others such as the Joint Staff) identify the C2 requirements and other capabilities necessary to support expeditionary maneuver warfare and OMFTS support from a sea base.

## Fires and Maneuver Supporting Focus Area

### Background

The Lab has been investigating and experimenting with technology solutions to address improvements to fire support to, among other things, improve precision, terminal effects, responsiveness, and mobility. A focus of effort has been to address the unique requirements of fire support in respect to *Operational Maneuver From The Sea* (OMFTS) and specifically *Ship To Objective Maneuver* (STOM) as well as the subset of *Military Operations In Urban Terrain* (MOUT). OMFTS/STOM operations have several unique challenges, beyond those posed by conventional operations, because of the distances traveled by the littoral penetration force and the initial isolation of those first elements.

As first demonstrated in the *Hunter Warrior* AWE in 1997, the key fire support for a OMFTS/STOM force must be sited with that STOM force to ensure responsiveness in all situations. Long times of flight and/or processing reduced the effectiveness of fire and all but eliminated the attack of fleeting and mobile enemy targets. High volume of fire requirements, such as preparation fires, final protective fires, etc., could not be addressed using sea-based fires beyond the basic 30 km maximum range of conventional 5-inch caliber naval surface fires.

Another important aspect of STOM operations is that any system accompanying the STOM force must be sized to fit within the envelope of the MV-22 Osprey or helicopters and the logistic support, that is the ammunition for those weapons, must represent the optimum effects available per

shot for the most efficient volumetric and weight package per sling load/cargo bay/truck bed. During this same AWE, the marked improvement in precision targeting devices proved to be a decisive factor in the prompt engagement of mobile enemy targets. Even though these first-generation systems were bulky and complex, significant gains in target identification, acquisition, and fire mission transmission speed materially improved the combat effectiveness of the STOM elements.

During *Urban Warrior*, the focus was on combat in the urban environment and very precise targeting, fast response times, and tailored effects of those fires moved to the forefront. The targeting required precision in the vicinity of a few meters with an exact target altitude to ensure that weapons engaged the exact room being targeted and would not kill friendly forces or noncombatants in close proximity. Tailored effects were modeled to focus the lethal or less than lethal effects on the target and not cause damage that would threaten or impede the MAGTF mission. Fires coordination experimentation only began to touch on the complexity of allocating, adjudicating, and deconflicting fires and flight paths in the compressed three-dimensional space above and within the city.

*Urban Warrior* demonstrated that once again, combat within a city is exceptionally close-coupled, vertical as well as planar, and extremely dangerous. New directions in technology will be required to offset an enemy's advantages and reduce the MAGTF's casualties by using supporting arms within the walls of the "urban canyon".

Based on experimentation results and the lessons learned from recent LTA, it is clear that the continued evolution of fire support to support OMFTS/STOM and urban operations, as well as more convention combat scenarios, entails continued technological development

and experimentation in the following directions:

**Responsiveness.** All forms of fire support need to be delivered as quickly as possible to ensure the destruction of key enemy strengths and offsetting the relative vulnerability of the lead elements of an OMFTS/STOM force. The more quickly a target is struck, the more likely the threat will be neutralized and the more effectively that threat is removed from the path of the OMFTS/STOM force. In the case of mobile targets, fast response times are essential: enemy forces can quickly overwhelm or escape the MAGTF if they can't be attacked quickly. All elements of fire support, from the precision targeting systems to the fire support coordination system to the firing systems themselves need further advancement to adequately support the OMFTS/STOM force.

**Precision.** Striking an enemy target with the first round fired is an achievable ideal and an essential requirement for a force with limited logistic access. This precision requires accurate target location by ground observers, UAVs, and other elements of the RSTA cloud, then state-of-the-art technical fire direction flight path prediction that incorporates real-time meteorological data, velocity variances, experience-based data and other techniques to dependably place projectiles close enough to neutralize or destroy a target on the first shot. In addition to improving the effectiveness of fires against the targets engaged, this will also allow greater depth of engagement against detected enemy forces, extending the *reach* of OMFTS/STOM elements while reducing the logistic loads required to effectively support our forces in long distance operations.

**Flexibility.** Supporting the OMFTS/STOM maneuver forces requires systems and weapons effects that can accommodate the

wide range of terrain, weather and tactics that will be encountered. The initial entry forces of the STOM force will be constrained to work within the envelope of the interior of the MV-22 Osprey or helicopters which is to say, they must be very compact and light.

Fire support systems that are designed to conform to these specifications must be able to be upgraded with the addition of modules to adopt new characteristics and capabilities as the OMFTS/STOM force transitions to a mobile maneuver force. The effects delivered must be able to confront all types of target in any feasible environment, such as reduced effects when supporting an urban attack, or the ability to defeat field fortifications or light armor or penetrate heavy vegetation cover in addition to the conventional *infantry in the open* type of targets.

**Mobility.** As previously mentioned, all of the parts of the initial entry force must be internally transportable within the MV-22 Osprey or helicopters. External lifts, while adequate for short distance movements, cannot be used for long distance STOM operations. Aircraft that are carrying an external load are constrained by slow speed, excessive fuel use, and vulnerability. Over 100 nautical miles, the penalties posed by external loads make it impossible to carry any meaningful load in that manner. Once the force is on the ground, fire support systems must be able to move at the same speed and over the same terrain as the maneuver force. Once the STOM force has transitioned to a conventional mobile force, then the fire support systems must be able to transition to the same mobility.

**Logistic Supportability.** Ground fire support is a function of delivery means positioning, range, rate of fire, and ammunition flow. Ammunition flow depends on the means available for movement ashore, surface

transportation and roads available, airlift assets and approach lanes available and in the case of larger caliber weapons, the availability of material handling equipment at the firing positions. Like the flow of fuel to an engine, ammunition movement determines the tempo of the weapon rates of fire and the amount of fire support effects available for influencing the direction of the battle.

These and other areas were shown to be deficient in the context of these warfighting experiments and these deficiencies and the work of the OMFTS Working Group have helped guide the Lab to pursue directions to address these deficiencies.

### TECHNOLOGICAL DEVELOPMENTS.

**Precision Targeting.** The first technological direction has been to continue to develop the technologies for precision targeting systems. Observers have been hampered by equipment that has been either primitive or heavy, complex, troublesome and often inaccurate. The first prototype precision targeting systems also had difficulty communicating the fire missions through legacy fire support coordination systems and the potential gains in responsiveness were lost through these interruptions.

The Lab has experimented with several competing eye-safe laser range finding systems that were incorporated into the Forward Observer/Forward Air Controller (FO/FAC) system to allow direct transmission of fire missions to fire direction/fire support coordination systems. The Lab has also experimented with UAV-borne precision targeting systems using the Dragon Drone UAV as a platform, as well as the TAC-ATA system developed by the Naval Surface Warfare Center at Dahlgren. These experiments demonstrated that precision-targeting devices could lead to a leap-ahead

capability for the attack of enemy targets and greatly facilitates accurate employment of supporting arms. The main technological/engineering impediments to fielding next generation precision targeting systems are:

**Weight.** Several of the available targeting systems weigh between 30 and 45 pounds, less radios, and limit the mobility of ground observers.

**Complexity.** Several precision targeting systems require multiple connection cables, batteries, and modules to function. Additionally, many of the prototype systems have complex programs that require completing successive data entries to complete the preparation of a fire mission.

These complex systems require time to process a fire mission and a high level of training for observers to employ them. One observed effect has been the tendency of the developers of precision targeting software to make the observer provide the maximum amount of data – such as the detailed description of targets – to facilitate the decision-making software at the fire support coordination centers. This has had the effect of increasing observer data entry requirements and reducing fire mission responsiveness.

**Location Errors.** Most or all of the available precision targeting devices use a magnetic compass for target direction. These compasses introduce an error of 15 mils or more, even if the compass is properly declinated for its surroundings. This error can equate to at least 75 meters at 5,000 meters. The use of newly designed miniature gyros can provide much greater directional accuracy and reduce these errors.

**Communication.** Systems developed to work with some fire support coordination software systems will not work with others.

The message address formats in present use are being supplanted at some future date by a new joint format system, which is not yet available. This has had the effect of constraining the development of any new systems until the new formats are defined.

**Fires Adjudication/Fires Allocation.** This arena of fire support coordination has been the most difficult technological challenge of the sensor-to-shooter chain for OMFTS/STOM. During the AWEs and LTAs, several systems were used in experimentation and weaknesses surfaced with all of them. The function of these types of systems is to facilitate target attack to support the commander's intent for the scheme of maneuver and to choose and allocate fires based on this basic priority system. The difficulties encountered during our experimentation have been:

**Universality.** None of the systems used – legacy or new technology – can adequately merge air fires and naval surface fires and ground fires. In the AWEs in particular, multiple systems were required to coordinate these different elements of fire support. Any system to coordinate fires for the MAGTF must have complete blending of all types of fires.

**Communications.** All of the systems used required “fixes” and workarounds to communicate with each other. Even with these attempts to merge systems, important gaps in target coverage and fires deconfliction resulted.

**Three Dimensional Deconfliction.** With the constrained airspace above the OMFTS/STOM area of operations and in particular during MOUT operations, deconfliction of manned and unmanned aircraft and projectile flight paths is unsolved. The present systems rely upon Aircraft Coordination Airspace (ACA),

delineating approach and retirement lanes of a given upper and lower altitude. This technique constrains aircraft maneuvering to deal with anti-air threats and constrains ground and naval firing systems to ballistic solutions that avoid those ACAs. A future system must enable unrestricted aircraft maneuver while simultaneously facilitating all available fires without endangering aircraft.

An additional question of philosophy in the development of fire support coordination systems has been whether these systems are centralized at higher levels or decentralized at the lowest levels. In the centralized systems, higher headquarters is able to make use of intelligence assets and larger, more complex computer systems to implement the commander's intent.

The negatives of this type of system are the multiple communications links required to implement target acquisition and fire order transmission distribution and the necessary complexity of this type of system. This centralized system is vulnerable to failure of these links and will stretch this vulnerability the further these links are extended, such as during long-distance STOM operations.

The opposite case – using decentralized coordination systems – results in conduct of fires allocation and deconfliction at the battalion/MEU level. This philosophy puts fires management in the hands of the supported commander and simplifies communication and reduces response time. The disadvantage of this type of system is that it may not maximize the use of all available fires systems and could add complexity to the problem of airspace deconfliction. Some combination of both philosophies needs exploration for OMFTS/STOM operations.

**Fires.** The Lab has experimented with several fire support systems and concepts during LOE, LTA, and AWE. These experiments have included several types of weapons and calibers, ground and air-delivered, conventional and urban combat scenarios, with a focus on using technology to address the key deficiencies in MAGTF fire support. As delineated in the Artillery Operational Advisory Group (OAG) letter of 21 July 2000, fires must be:

- **Accurate** and **lethal** fires, continuously available in all weather conditions
- **Responsive** through integrated C2 nodes
- **Lethal** across a spectrum from high volume shaping to precision destruction missions
- **Mobile** in range capability, speed of movement, and ammunition transportability
- **Expeditionary** in strategic movement, support, and sustainment
- **Integrated** with air, NSFS, and intelligence systems
- **Flexible** through a balance of **complimentary** fire support assets that can be tailored to handle any mission along a spectrum of conflict

To get there, we need a *triad* of short, medium, and long-range fire support systems that have complimentary and mutually supporting capabilities.

One particularly promising set of experiments centered on automating key functions of ground fire support within the gun system. In the Mobile Fire Support System (MFSS), a 120mm rifled mortar, the functions of communication, power movement of the firing elements and loading systems and

automated fire control, and precise positioning and pointing systems were combined to reduce response time and increase accuracy in a medium-caliber, medium-range system. In addition, this system is internally transportable within MV-22 Osprey aircraft.

During extensive experiments, the MFSS demonstrated rapid response times from reception of fire mission to firing (12-20 seconds) and heightened precision (CEP of approximately 25m). Several experiments explored a shortened *sensor-to-shooter* chain including what is believed to be the world's first live-fire direct transmission of a target to a firing system by ground observers and by UAVs.

Experiments have also demonstrated the reduced *footprint* of employing this or similar systems, since there is no requirement for additional communications, fire direction, or survey teams required to support firing operations. As a result of the success of these experiments, the MFSS has been specifically mentioned as a potential candidate to fulfill the draft Expeditionary Fire Support Mission Need Statement.

Another series of experiments with air-delivered fires in urban operations, the Aviation LTA at Yuma, Arizona, demonstrated the effectiveness and state of development of precision air-delivered fires in a MOUT environment and laid out the directions for further development and experimentation. The main areas of further development were:

**Precision targeting.** As with ground-based fires, precise location of targets in three dimensions is critical to the effective employment of air-delivered fires in MOUT.

**Laser Designation Systems.** This capability is key to precision attack with laser-guided weapon systems and the lasers were shown to be ineffective during the employment of obscuration.

**Scalable-Yield Weapons.** Air-delivered weapons are the most powerful supporting arms available in our inventories. In many cases during urban combat, the larger of these weapons would be constrained from use because of the danger to friendly forces and noncombatants in close proximity and because of the excessive rubble created. A scalable yield system to give weapons that were usable in close combat within a city was shown to be needed.

**UAV Employment.** The UAV was demonstrated to be effective in targeting for the employment of air-delivered fires in an urban environment.

## The Campaign Plan

Based on the experimental results gained and the stated requirements by the Division Commanders, the OAG and MCCDC, the Lab will develop and test concept demonstrators for the required technologies and assist MCCDC and MARCORSYSCOM with experimentation to prepare promising technical solutions for acquisition and fielding.

## PRECISION TARGETING

**Universal Combined Arms Targeting System (UCATS).** Combining the Litton Melios laser rangefinder with the Advanced Close Air Support System (ACASS) in the Ruggedized Handheld Computer (RHC) with the development of the software changes to incorporate the ground and naval surface fire call for fire formats and the modem to allow communication over VHF-FM SINCGARS

radios can provide a *leap-ahead* targeting system very quickly. This system would allow an observer to target accurately out to 10,000m and process air, naval, and ground fire missions interchangeably and simultaneously.

Exploiting the color map projection, aircraft tracking, internal GPS card, communication with ATHS-equipped AV-8B aircraft, and full nine-line generation capability of the ACASS, the added capability of the UCATS would provide observers with a simplified yet powerful precision targeting tool that would weigh 10-12 pounds and require a minimum amount of training. UCATS would supplement the Target Location, Designation and Handoff System (TLDHS) to provide a lighter, simpler system without laser designator for squad or platoon-level observers. UCATS is projected to cost \$250K for four prototype systems, available in June 2001.

## Upgraded UAV Targeting System.

Continuing with the development work initiated with the Dragon Drone targeting system and the TAC-ATA system, a new generation UAV targeting system, which allows target acquisition using a Synthetic Aperture Radar (SAR), is being proposed. The SAR system prototype will be tested this system in an LTA taking place at Yuma AZ during summer 2001. At the same time, a new system to relay targets from the UAV to other systems is being tested in an LTA. This capability would allow the *Dragon Warrior* UAV and others to relay targets to aircraft, fires coordination centers or the weapon itself. To upgrade the precision of the UAV targeting system, a geolocation system is being examined that would allow the UAV targeting system to calibrate its targeting system by aiming at known geographic points.

**Enhanced Target Acquisition and Locating System (ETALS).** This project is being initiated by the Naval Surface Warfare Center, Dahlgren to develop a miniature gyro system to replace the magnetic compass system in precision targeting devices. Resembling but slightly smaller than a hockey puck, ETALS promises 3-5 mil accuracy in direction to greatly improve target location accuracy, including when targeting from a mass of metal, such as an armored vehicle.

## FIRES

### Background

As described by the Artillery Operational Advisory Group (OAG) to the PP&O Ground Fire Structure review, "We need a Very Lightweight Expeditionary System (now referred to as EFSS – either heavy mortar or very lightweight howitzer) to penetrate deep with maneuver units, under air and naval surface fire support. Transportable by surface or air, the EFSS will provide the lethal close fires required in built up littoral areas." As a potential for the EFSS requirement, the MFSS is ready for further experimentation and developmental testing.

**Indirect fire precision development.** By incorporating the ballistic information gained during nearly 500 rounds of experimental firing, the MFSS ballistic kernel would be upgraded to match impact prediction with actual flight path data. This project would give the MFSS nearly a "first round fire for effect" capability and begin to approach precision munitions performance from a simple and inexpensive ballistic system.

This capability addresses the OMFTS Working Group recommendations for a weapon system that can support maneuver forces with high volumes of "non-precision"

projectiles, yet retain a nearly precision munitions accuracy. This upgrade will cost \$20-40K and will take 6 months to be ready for live fire testing

**MFSS Lightweight Carriage Development.** Because the MFSS was designed and built very quickly, system weight – nearly 6,500 pounds – is excessive for towing by HMMWV and doesn't allow much ammunition to be carried when MFSS is transported by MV-22. PM Mortars and ARDEC Picatinny Arsenal estimates that with the firing data gained so far, the MFSS overall weight can be reduced by over 2,000 pounds to between 4,200 and 4,500 pounds. This project to support the EFSS draft MNS would take one year and cost approximately \$1.5M to execute. At the completion of this and the previous effort, the MFSS would be ready for transition to MARCORSYSCOM/MCOTEA for acquisition Milestone II evaluation as a candidate EFSS system.

**Modular Firing System.** Using the MFSS as the towed variant, the firing system would be modified to allow removal from the towed carriage and rapid installation on an LAV. This capability would facilitate OMFTS/STOM operations by providing the MFSS/EFSS as an MV-22 internally transportable fire support system that can rapidly transition to a mobile fire system mounted on an LAV. This capability with this system would provide the *responsiveness, accuracy, variety of munitions, volume of non-precision projectiles and a capability for close and continuous fire support*. Called for by the OMFTS Working Group. This project can be completed within 12-18 months and would cost approximately \$2M if an LAV were provided from available inventory.

**In Stride Fire Support.** In parallel with the development of an LAV variant of the MFSS, a fire on the move capability would give the

MAGTF the capability to attack targets without having to stop and interrupt the momentum of a maneuver force. Using the on-board laser ring gyro of the MFSS, the fire control computer would stabilize the gun tube and position it to fire when the correct azimuth and elevation is reached. This capability would provide a true "leap ahead" for maneuver fire support.

**Automation Development Support for the M777 155mm Howitzer.** Using the experience gained through the MFSS development and testing, The Lab can assist MARCORSYSCOM with the development of the P3I positioning, pointing and fire control/ballistic kernel for 155mm artillery. The addition of these capabilities would increase accuracy and greatly reduce the time to fire and the number of supporting teams to provide 155mm fire support.

**HIMARS Tests and Experimentation.** The Lab will assist MARCORSYSCOM with technical assistance and participation with HIMARS tests, particularly with the integration of HIMARS into the sensor-to-shooter network/experimental fires adjudication and allocations system.

## MANEUVER

### Background

During the Lab's three AWEs, the maneuver focus has centered on supporting integration of technologies into the Marine Corps 15-year effort to implement the *maneuver warfare doctrine*. Initiatives for improvement have focused on two operational contexts *OMFTS*/*STOM* and emerging *Urban Operations* concepts.

The Lab will continue to examine maneuver initiatives that address enhanced power projection from the seabase, expanding the

*STOM* experimentation context to include Expeditionary Maneuver Warfare.

Recognizing the littoral will be increasingly urban, the Lab will continue collaborate with other agencies to explore and develop maneuver and mobility concepts uniquely suited to the urban environment, and will continue to evolve and document techniques to support both the current and future MAGTF undertaking urban operations.

### Seabased Mobile Combined-Arms Forces

The *OMFTS* concept proposes air-ground combined-arms forces are critical early response forces for contingencies in order to prosecute a campaign designed to influence the enemy's strategic plans. Focused at the operational level, *OMFTS* proposes *STOM* as a tactical means to achieve operational objectives, conceptualized to penetrate the enemy's integrated coastal defense to operational depth, and designed to preserve combat power to achieve those operational level objectives.

The Lab will continue to examine such applications of maneuver warfare to amphibious power projection, including operational maneuver techniques to enhance longitudinal penetrations to directly address the operational objective. Future shortfalls in operational maneuver will prove more critical to the Marine Corps than the Army, for amphibious forces enjoy an attribute complementary to maneuver warfare, operational mobility along seaward flanks. This is the attribute on which *OMFTS* is built.

### STOM

The Lab's examination of future MAGTF forces to date has included required maneuver capabilities, looking at the mechanics of *STOM* through wargaming, simulations and

experiments. *Capable Warrior* LOEs 1-3 examined command and control techniques particularly designed to facilitate penetration by the STOM force and to enhance the sought after *high tempo operations*. *Capable Warrior* LOE 5 and *Millennium Dragon* Joint Experiment examined C2 and employment techniques for adaptively maneuvering a surface maneuver element through a mined littoral.

To achieve high tempo ops, successful rapid decision-making must be supported by the capabilities to effectively *Move, Shoot and Communicate* adequate to the operational mission. In the *Move* category, the Marine Corps continues integrating both technology and techniques, which show opportunity to enhance MAGTF operational level effectiveness.

The high water speed and firepower of the Advanced Amphibious Assault Vehicle will support expeditionary force by providing an amphibious *break through* or assault force, creating the necessary penetration points along the littoral defenses.

The near term production of the MV-22 and far term production of the MAGTF Family of Fighting Vehicles (MEFFV), future replacement for the LAV and M-1 fleets, will invite an opportunity to equip the MAGTFs with technologies to operate at consistently at operational distances once that littoral penetration is achieved

## Aviation's Increasing Role in Maneuver

Recognizing the destructiveness and flexibility of air power, the MAGTF will no doubt possess a capability to conduct *STOM* by air, combining seabased air and missile strike operations with seabased air assault.

The greater challenge will be to create a seabased air-ground combined arms force

capable of elevating the combined arms dilemma from the tactical to the operational level. Designing an air-ground combined-arms force to adeptly accomplish the mobile force role envisioned by both Marine Corps and Army *transformation* efforts continues as a fundamental capability issue within the *EMW* and *STOM* concepts.

The role of air in maneuver will continue to be weighed by both the Marine Corps and the Army over the next 10 years. Air Combat Element capabilities provide the MAGTF a unique advantage in this area and their unique contributions to maneuver will be considered in examining in maneuver concept exploration initiatives.

## Technology and TTPs

The Lab organizes its focus on maneuver around two types of partnerships. In order to understand and influence the changing nature of future fires and maneuver, the Lab collaborates in partnership with Science and Technology (S&T) agencies such as ONR, DARPA and TARDEC, to support concept exploration of future acquisitions. The purpose of this thrust is to support co-evolution of emerging technologies and operational concepts in development by Marines and sailors of the Combat Development Process. This is predominately a 6.2 supported S&T thrust of the maneuver supporting focus area.

In order to understand the problems of the current operating forces and how current technology might support their resolution, the Lab will collaborate with specific Operational Advisory Groups sponsored by the GCE Advocate. The purpose of this thrust is to support integration of technologies into current operating forces by co-evolving, with the operating forces, TTPs that facilitate use of available, commercial-off-the-shelf

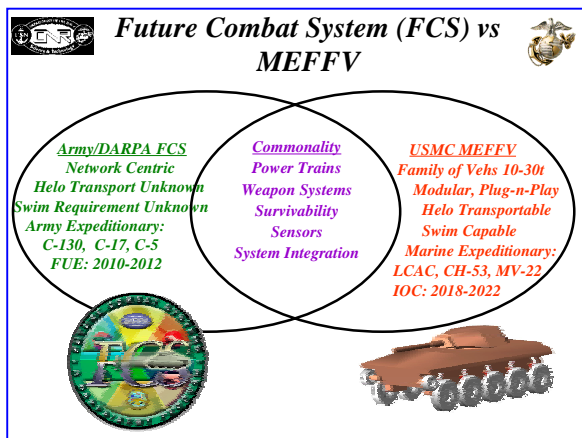
technologies. This is predominantly a “6.3” supported S&T thrust of the maneuver focus area.

## Technology Integration through Concept Exploration

In assessing the needed ground combat capabilities of Expeditionary Maneuver Warfare and OMFTS, the Marine Corps has begun to articulate needs unique to that future MAGTF which practices maneuver warfare, is projected from the seabase, and focuses at the operational level. To understand those unique capability needs, the Maneuver Focus Area will examine the following issues.

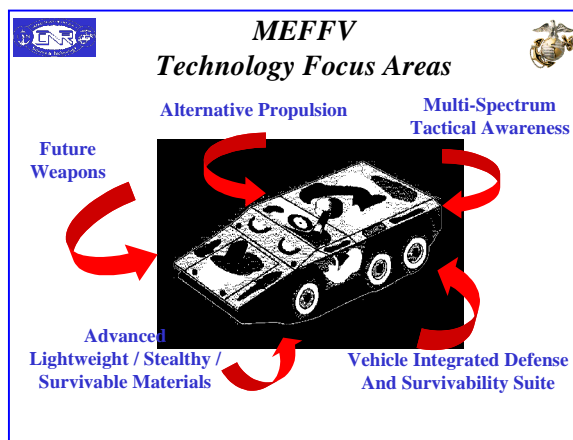
## MEFFV Program

The MAGTF Expeditionary Family of Fighting Vehicles Program has initiated early activities to support design of a vehicle family for the mobile combined arms MAGTF. Now entering the Concept Exploration phase of acquisition, the S&T function of the program is specifically designed to leverage technologies advanced by DARPA and the Army's *Future Combat System* program. This initiative will provide liaison to leverage the most promising technologies for Marine Corps development and use.



Potential FCS/MEFFV commonalities:

- Both systems will be structured around common chassis to minimize sustainment requirements.
- Both seek to employ new weapons systems to enhance its organic firepower. New applications of weapons include a possible 120 mm mortar; examination of gattling or chain gun technologies -- of various calibers -
- in direct fire role. New applications of direct fire and indirect fire precision stand off weapon systems (LOSAT, HIMARS, HMAA).
- Both seek means to increase unit security through very active reconnaissance and increased situational awareness, (organic UAVs and UGVs, foot and mobile reconnaissance teams, and mobile or fixed sensors. etc)
- Both seek improvements in survivability of mounted forces while reducing logistics requirements through several technical approaches. Approaches include: alternative fuels and propulsion means, active protection survivability suites, lightweight armor and stealth technologies and dramatic improvements in maintenance cycles.
- Both seek to incorporate a means of integrating necessary Joint support while employed. Examples include integration of joint air support for sustainment and strike, joint ISR sources, and employment of long range interoperable C4I.



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## Reconnaissance, Surveillance, Target Acquisition Vehicle Program

The RSTV Program is a jointly sponsored DARPA/ONR technology demonstrator established to build a MV-22 transportable, hybrid-electric powered, mobile RSTA suite with advanced survivability features. The Lab in conjunction with ONR will continue to examine the roles of the RSTV in the air maneuver element of the *STOM* force.



RSTV Concept Vehicle

## Other Maneuver Technology Areas

The Lab will look for opportunities to collaboratively work with ONR to examine technologies supporting maneuver through several other initiatives. These include:

- Integration of autonomous systems into the operating forces,
- Enhanced mine detection technologies and neutralization means,
- Predictive diagnostics to reduce logistic requirements ashore, and
- Expanded use of modeling and simulation to support development of future maneuver and mobility systems.

## Effect Based Operations/Seabased Operations and Maneuver

The Lab participates in wargaming by the Naval Warfare Development Command

(specifically the Innovation Cell of the Global Wargame series) to examine:

- The role of suppressive effects in facilitating maneuver, and the particular roles of maneuver in facilitating the full range of Effects Based Operations.
- The required capabilities for the future MAGTF that maneuvers from the seabase, through a mined littoral, ashore, and return.
- The capabilities required to enhance MAGTF operational maneuver. Specifically, the implications of logistics management policies on operational maneuver, the characteristics of fires which are unique to supporting operational maneuver, and amplification of the operational maneuver element concept articulated in MCCDC's "Sustained Operations Ashore" Concept Paper.
- The capabilities required to establish a LCAC Landing Zone during STOM, (cooperating with a Craft Landing Zone Clearance TTP Program, see below).

## Unmanned Ground Vehicles/Systems

The Army and the Marine Corps consolidated efforts to develop battlefield ground robotic vehicles in the Unmanned Ground Vehicle (UGV) program, which serves as the focal point for fielding ground robotics to the U.S. Military. The UGV/S JPO has several programs that fall under three product categories:

- Family of Tactical Unmanned Vehicles (FTUV)- The FTUV product is focusing on a variety of different systems to conduct reconnaissance and surveillance missions for the U.S. Marine Corps and Army
- Vehicle Teleoperation (VT)- The VT product is focusing on developing a

Standardized Robotic System (SRS) to teleoperate a variety of military engineer vehicles to accomplish mine detection and clearing and obstacle breaching missions.

- Robotic Combat Support System (RCSS)- This program is focusing on developing a small, lightweight vehicle for the U.S. Army Engineers to conduct anti-personnel mine neutralization missions. It will evolve into a multi-purpose vehicle capable of clearing wire obstacles, placing explosives, and carrying equipment.

- The Lab collaborates with ONR and the UGV/S JPO and to examine the particular role of robotics in supporting mobility tasks in Urban Operations.

### **Technologies and TTPs for the Operating Forces**

Adjusting to changing missions – sometimes while changing tools and often while changing environments – require the operating forces to use easily tailored TTPs. By modifying TTPs, they can adapt current practices to meet new missions.

The Lab's *X-Files* program has addressed a number of TTP improvements while the operating forces continue to identify more opportunities. The Marine Corps' Operational Advisory Groups (OAGs) are central to the process of evolving the most effective operating forces. The following are a selected list of *maneuver initiatives*, identified by the OAGs for examination by the Lab or ONR:

- LAR Battalion Scout Sniper Platoon, [LAR OAG]. Determine the effectiveness of adding a Scout Sniper Platoon T/O and T/E to the LAR Battalion T/O&E.

- LAR Battalion Motorcycle TTP, [LAR OAG]. Determine the best TTPs for

employment of motorcycle couriers as part of the Battalion HQ T/O.

- Far Term LAR OAG Plan, [LAR OAG]. Develop and maintain a dialog for LAR Battalion personnel input to LAV SLEP efforts and to the MEFFV Concept Exploration phase.

- LAR/Interim Brigade Combat Team Information Exchange Program, [ONR MEFFV Tm/TRADOC/MCWL]. Establish and maintain a dialog between the Army's IBCT Evaluation Team at Ft Lewis, WA and the members of the LAR OAG community, in order to improve Army employment of LAVs and provide LAR community visibility of evolving technologies within that Army program.

## WARGAMING

**Purpose.** Wargaming is a highly flexible exploratory and assessment methodology that can apply to a broad range of situations outside of “war” in the strict sense of the term. An operational definition is:

*Wargaming is the artificial replication of a situation of competition or conflict not involving actual military forces. It is characterized by human decision-making which impact the course of events throughout, and revolves around the interaction of two or more opposing forces guided by predetermined objectives, rules, data, and procedures designed to depict an actual or assumed real world situation.*

Wargaming is particularly suitable for generating, refining, and assessing concepts, plans, issues, and technologies; assessing alternatives (COAs, etc.); identifying capabilities and deficiencies; replicating conditions difficult to reproduce in peacetime; and reducing surprises.

**Key Programs.** The Marine Corps Wargaming Program, executed by the Wargaming Division of the Lab, is a comprehensive and innovative effort focused on advanced policy, concept, and operational exploration at several levels, Title X issues, Joint and external gaming efforts, experimentation track shaping and development, and combat development. Its principal “business lines” are briefly described as follows:

**Experimentation Track Wargaming** is a component of the Lab’s Innovation and Experimentation Process as a means of exploring, vetting, and assessing prior to committing resources. The wargaming

## Wargaming Programs

<u>Program</u>	<u>Originator/ Sponsor</u>	<u>Principal Recipients of Output</u>
• Sea Wolf 2000	• CMC/ CG,MCCDC	• CMC/CG,MCCDC, CNO,NWC
• Title X Gaming Management	• PP&O/CG,MCCDC	• D/CS PP&O,CG MCCDC,NWC,MCWL
• CHEM/BIO Wargaming Series	• WG/MCWL,CBIRF	• WG, CBIRF, HQMC
• “Unusual Suspects” Gaming; e.g., COTS, FDNY	• MCWL,CG MCCDC	• MCWL CG, MCCDC; HQMC
• Urban Warfare	• MCWL	• MCWL, Joint Staff
• Revolution in Military Affairs (RMA)	• OSD/NA, WG, MCWL	• OSD/NA, HQMC, MARFORLANT, JFCOM ,etc.
• US/UK NLW Urban Program	• PP&O, JNLWD	• D/CS PP&O/ JNLWD
• Project Ellis (Futures)	• WG, MCWL	• WG, MCWL, WDID, HQMC, Other Services
• OOTW Program – OOTW WEB Site/C.E.	• CMC,WG, CETO	
• Emerald Express Series – Culture Intel Seminar	• MCWL	• FMF, MCWL, MCCDC, HQMC, MCIA, NGOs
• Cultural Intelligence Seminar Series	• WG	• MARFORs, MCIA, NGOs
• Combat Decision Range (CDR)	• WG, MCWL CG, MCCDC	• Training Cmd, FMF, Reserves
• Tri-Marine War Game Series	• PP&O	• D/CS PP&O, RMs, Dutch Marines
• DMPLS War Gaming Program	• WG	• Naval Medical Community
• Sea II: Naval Command Relations	• CMC	• CMC, CG, MCCDC, D/CS PP&O
• Anti-Access/ Asymmetric Warfare	• WG	• CMC, CG, MCCDC, MCWL, WG
• Experimentation Track Gaming	• WG, MCWL	• MCWL, MCCDC, HQMC, JFCOM
• Educational Wargaming (JLASS+)	• MCU	• MCU, Service TLS
• National Defense Industrial Association WG Series	• WG, NDIA	

program occurs at the front-end of an experimentation track to assess concepts, issues, etc. that shape the direction of the track as a whole. Examples of experimentation track gaming includes the **Urban Warrior, Capable Warrior / Culebra, and Coalition Warrior Series.**

The **Title X Wargaming** effort coordinates and participates in a program of Service-sponsored war games that address future capabilities in the context of core Title X responsibilities to organize, train, and equip forces to execute each Service’s statutory roles and functions. These include the Navy’s **Global** series, the **Army After Next (AAN) Series**, and the Air Force’s **Global Engagement** series. Currently, the Marine

Corps does not have its own Title X war game, though it helped pioneer the effort in the late 1980s and early 1990s with the **CMC Policy and Strategy War Game Series**.

**The Weapons of Mass Destruction (WMD) Series** has been an ongoing program since the mid-1990's. Most recent efforts have focused on biological warfare to include Homeland Defense, command and control (C2), and employment of the Marine Corps Chemical-Biological Incident Response Force (CBIRF).

**The Sea Wolf 2000 (SW2K)** project was a result of the January 2000 Navy-Marine Corps Warfighters Conference. The purpose of SW2K is to assess the effects of the combat power of forward-deployed naval forces and immediate follow-on forces in early decisive combat operations in order to illustrate the unique integrated capabilities of the Navy-Marine Corps Team.

**Dynamic Decision Making** war games examine a wide array of principally non-



military organizations to leverage insights into decision-making and command and control issues on the digital, nonlinear battlefield of the 21<sup>st</sup> Century. These organizations include the New York Mercantile Exchange (NYMEX), the Federal Aviation Administration (FAA), and the Fire Department of New York (FDNY). The concept underlying the FDNY's

Battalion Chiefs Course was leveraged to develop the CDR. An initiative emerging from this game series is the **Combat Decision Range (CDR)**. The CDR provides a facilitated computer-driven, human interactive decision-making program for combat leaders from squad through field grade level. It is fielded throughout the operating forces and the Schools of Infantry as a prototype decision-making training tool and as an experimental means for disseminating changes in tactics, techniques, and procedures.

**Information Technology (IT) Executives** war games have been conducted to assist Marine Corps General Officers to assess future tactical IT systems, strategic acquisition issues, Marine Corps business models, and decision-making on the digital battlefield.

**The Urban Warfare Wargaming Program** embraces a broad and diverse spectrum of activity. These include Joint wargaming efforts, experimentation track wargaming, Revolution in Military Affairs (RMA), US/UK Non-lethal Weapons Wargaming Program, Project Ellis, the Operations Other Than War (OOTW) Center for Excellence, and **Cultural Intelligence seminars**.

**The Project Ellis and Revolution in Military Affairs** series of war games are executed to support the Marine Corps component of the overall RMA program for OSD Net Assessment. An exploratory program, the RMA gaming effort embraces a wide range of interests; e.g., future OMFTS concepts, urban warfare, experimentation track support, Joint experimentation, biological warfare, information warfare (computer network attacks), and countering anti-access strategies.

**Project Ellis** is a futures program that examines pivotal events in the strategic landscape. These may result in major changes to US strategy and the role of the Marine Corps therein. Project Ellis is named for Major Pete Ellis, whose identification of shifting strategic landscape in the Pacific and the corresponding need for an amphibious capability there had a decisive effect on the outcome of World War II.

**US/UK Non-lethal Weapons (NLW) Wargaming Program** is sponsored by the Joint Non-Lethal Weapons Directorate (JNLWD) and comprises an extensive venue to examine policy, operational, and capabilities issues for NLW employment across different levels of war and in different environments. The current phase of the program runs through CY 2000.

**Cultural Intelligence Seminars** are designed to provide the 'missing piece' in military planning, principally focusing on better understand those areas of prospective employment of Marine forces from the perspectives of potential enemies, allies, and neutrals. Non-defense agencies and NGOs are the focus participant pool, with Marines, of course, the ultimate beneficiaries.



**The Operations Other Than War (OOTW) Center for Excellence** provides a mechanism for exploring emerging concepts and disseminating the results via its web site to relevant participants in OOTW efforts. The OOTW Center for Excellence provides a point of entry to those in the Non Governmental Organizations (NGO)

community. The Emerald Express Series examines ongoing issues of critical importance in the OOTW arena; e.g., Emerald Express 99-2 focused on 26<sup>th</sup> MEU's experiences in Kosovo (peacekeeping) and Turkey (disaster relief).

**The Industry War Game** series is conducted in conjunction with the National Defense Industrial Association (NDIA). This program helps maintain a dialogue with industry, and facilitates a larger role for industry in Marine Corps events.

**Educational Wargaming** supports the Marine Corps University and Marine Corps participants in two major Joint gaming programs. The Joint Land, Air, Sea Simulation (JLASS) and Joint Flag Officer Warfighting Course (JFOWC) are both supported by Wargaming Division at Maxwell Air Force Base.

## Priorities of Effort

Wargaming Division also supports a variety of miscellaneous efforts such as the Commandant's Trust Study, Joint Strike Force Red Team War Game, and The National Institute for Urban Search and Rescue.

The two priority wargaming efforts will continue to be Title X Wargaming and, Concept Development Wargaming in support of Joint and Service Experimentation. There is currently no intent to establish an on-going Marine Corps Title X War Game.

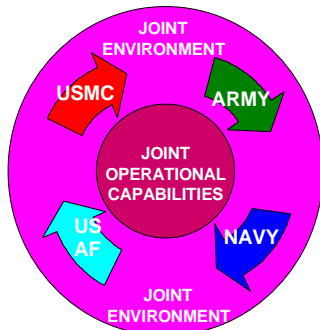
# EXPERIMENTATION CAMPAIGN PLAN -- 2001

## JOINT CONCEPT-BASE EXPERIMENTATION

### Joint Concept Development and Experimentation

U.S. Joint Forces Command's Joint Concept Development and Experimentation (JCDE) program is designed to develop and establish the joint operational environment of the 21<sup>st</sup> century, enabling the U.S. armed forces to achieve and maintain Full Spectrum Dominance, as envisioned in Chairman, Joint Chiefs of Staff *Joint Vision 2020* Campaign Plan 2001 (CPLAN 01).

#### JCDE Endstate

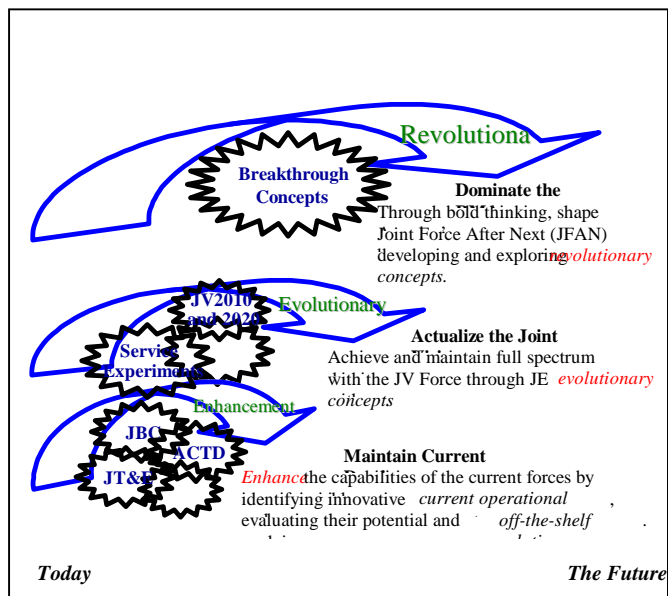


CPLAN 01 capitalizes on the successes of CPLAN 99 and CPLAN 00 and further refines the iterative process of concept development, experimentation, analysis and integration necessary to achieve the end-state of assuring qualitative U.S. military superiority and to prevent adversarial surprise well into the 21<sup>st</sup> century.

The JCDE program focuses on challenges in the joint and combined environment at the operational level of war, fulfilling guidance from the Secretary of Defense and the CJCS. The approach taken is concept-based,

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supported by new and emerging doctrine, organizational structures and technology.



The end product is a series of empirically based recommendations for change to joint doctrine, organizations, training and education, materiel, leadership, personnel, and facilities (DOTMLPF) programs.

An important early objective of the JCDE program is to develop an extensive community of organizations involved in military transformation, including the combatant commands, the Services, the Department of Defense (DoD), allies and coalition partners, other governmental agencies, military and civilian academia, and industry. In Fiscal Year 2001, Joint Forces Command will also explore ways to expand agency involvement and to include allies and potential coalition partners more fully in the JCDE program.

Joint Forces Command's CPLAN 01 provides for concept development and experimentation on three axes. The first axis explores use of off-the-shelf technologies in new and innovative ways to enhance current platforms and concepts for

operations. This axis supports maintenance of the current qualitative edge over existing threats.

The second axis focuses on supporting the achievement of *Full Spectrum Dominance*, described in *JV2020*. It explores emerging concepts, technologies and advanced information systems for use in supporting the evolution of today's joint force. It develops concepts that primarily use today's platforms (or their derivatives) in new ways to create greater synergy and effectiveness.

The third axis explores revolutionary concepts and technologies that will result in transformation of the force, enabling continued success against the challenges associated with the Revolution in Military Affairs. Interoperability of systems and functions is a key element to the success of all three efforts.

CPLAN 01 focuses on high-priority tasks assigned to Joint Forces Command in Defense Planning Guidance and the Chairman of the Joint Chiefs of Staff's Instructions on JCDE. Joint Forces Command's efforts in FY01 and beyond

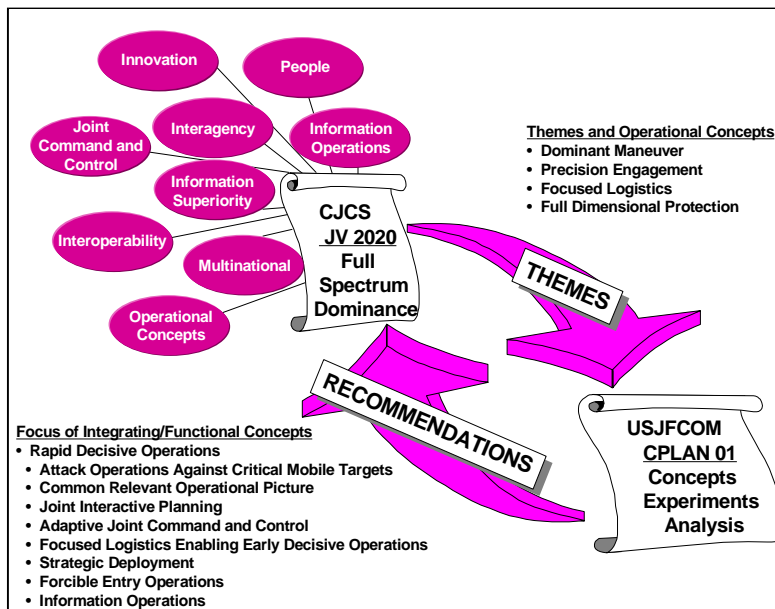
emphasize continued development and refinement of and experimentation with *Rapid Decisive Operations (RDO)* as the integrating concept enabling a fundamentally new approach to joint and combined combat operations in the 21<sup>st</sup> century.

RDO addresses how a Joint Force Commander can determine and rapidly employ the right balance of air, land, sea, space and electromagnetic spectrum capabilities in an intense, focused, non-linear campaign against a capable, regional power to defeat the adversary's strategic and operational centers of gravity without a protracted campaign. The RDO concept applies to all three axes of JCDE and holds great promise of providing early DOTMLPF recommendations.

The CPLAN 01 concept development and experimentation program also focuses on eight supporting "functional" concepts that provide critical capabilities for RDO. These are *Attack Operations Against Critical Mobile Targets*; *Common Relevant Operational Picture*; *Adaptive Joint Command and Control*; *Joint Interactive Planning*; *Focused Logistics*; *Enabling Early Decisive Operations*; *Information Operations*; *Forcible Entry Operations*; and *Strategic Deployment*. Three new proposals entering the pre-concept phase of development are *Assured Access*; *Joint Intelligence, Surveillance and Reconnaissance*; and *Effects-Based Operations*.

## MARFORLANT G-8

The Commander, Marine Forces Atlantic has been assigned the Marine Corps lead for coordinating Joint Experimentation issues.

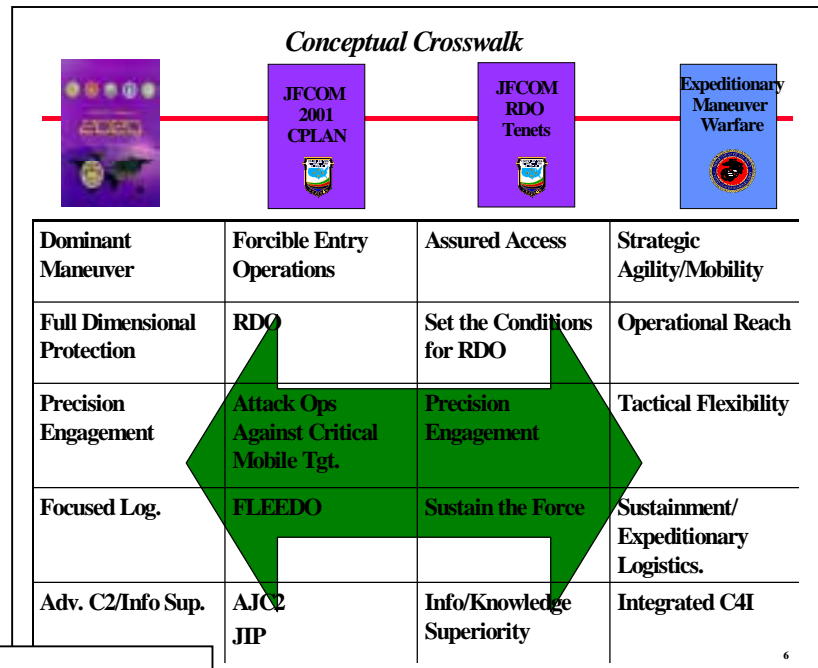


## EXPERIMENTATION CAMPAIGN PLAN -- 2001

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The MARFORLANT G-8 exercises Staff cognizance for representing the Marine Corps with the JFCOM staff for JCDE, coordinates DOTMLPF input into the Marine Corps CDS, and coordinates integration of Marine Corps Science and Technology issues in support of the JCDE.

The Lab is assigned as the single point of contact for MCCDC for supporting MARFORLANT G-8 in the JCDE, to specifically include joint experiment design, execution, and assessment.



### Millennium Challenge 2002



MC02 is scheduled for execution from 18 Jul - 09 Aug 2002. Concepts to be incorporated into the experiment design include the Army *Medium Weight Brigades*, Naval *Services Forward . . . From The Sea*, Marine Corps *Ship-To-Objective Maneuver (STOM)*, and Air Force *Expeditionary Aerospace Forces (EAF)*. *Rapid Decisive Operations (RDO)* is the central JFCOM concept for MC02 and will be experimented with in consonance with the experimentation of a new Joint Force Headquarters (JFHQ) organization.

### Millennium Challenge 2002 (MC02)

MC02 is a congressionally mandated, SECDEF directed, U.S. Joint Forces Command (USJFCOM) sponsored joint field experiment. MC02 will be a large-scale, live, virtual, and constructive joint field experiment and demonstration, incorporating elements of all the Services and Special Operations Command critical to future warfighting capabilities and forces at the operational level of war.

MC02 is designed to demonstrate the execution of a RDO using the projected forces/capabilities of this decade (up to and including 2007).

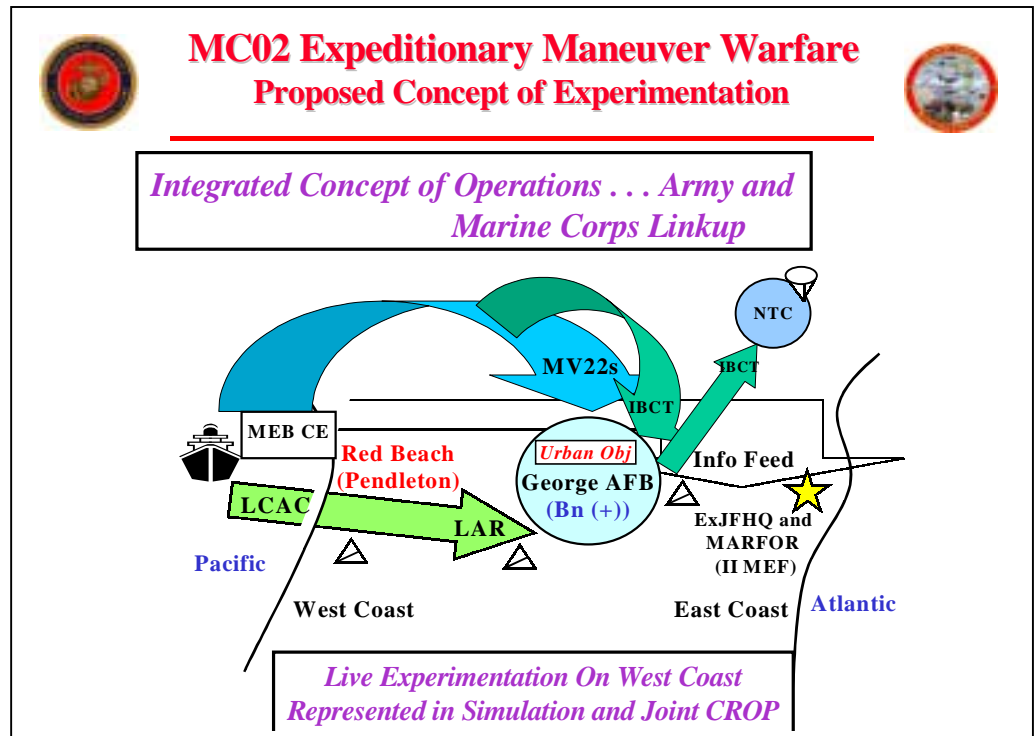
**Expeditionary Maneuver Warfare (EMW).** EMW is the Marine Corps Service operational capstone concept that supports RDO. Accordingly, the Marine Corps will seek to explore the effectiveness of EMW -- which includes STOM as a supporting concept -- as to its application to Joint Vision (JV) 2020 and the various JFCOM

concepts (RDO, Forcible Entry Operations (FEO), Joint Interactive Planning (JIP), etc.). In essence, the Lab will assist MARFORLANT in exploring whether the operational imperatives of EMW enable a JFC to conduct RDO, thereby attacking the coherence of the enemy and his ability to fight.

### Marine Corps Concept of Experimentation

The MC02 experiment is the centerpiece for accomplishment of many of the Lab's 2002 experimentation goals. Accordingly, the Lab will combine service and joint interests to create a comprehensive and balanced focus for MC02. In order to satisfy the Marine Corps objectives for MC02 and enable the JFC's execution of a RDO during MC02, the Marine Corps Service experiment will incorporate the execution of EMW by using a STOM maneuver force. It will do so with both live and simulated experimentation on the west coast with representation in the joint Common Relevant Operational Picture (CROP).

Since MC02 is the culminating event for the Lab's 2002 goals, the live STOM force will validate the Urban Combined Arms Exercise (UCAX) MOUT concept using the joint field experimentation environment established by the JFCOM scenario. Using the UCAX to provide the environment, the Lab will also conduct experimentation in RSTA, Logistics, and C2IT.



**C2IT** -- C2IT experimentation will explore the integration of joint operational and service tactical information in the CROP, on-the-move communications, tactical level information security, and communication architecture enabling EMW.

**RSTA** -- RSTA experimentation will explore service and joint ISR pictures in order to enhance SA, precision targeting, combat identification, and improved decision making.

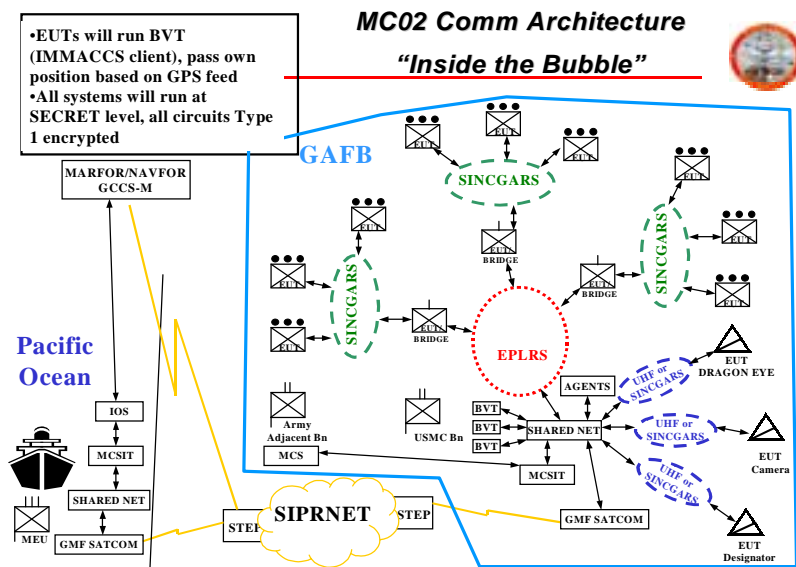
**MOUT** -- MOUT experimentation will explore the impact the urban environment or complex terrain has on Effects Based Operations (EBO), precision targeting, combat identification, urban reconnaissance, and information requirements in and out of the CROP.

**Logistics** -- Logistics experimentation will explore integrating various afloat logistics C2 systems with intelligent agents in order to enhance the ability to sustain an RDO/STOM force.

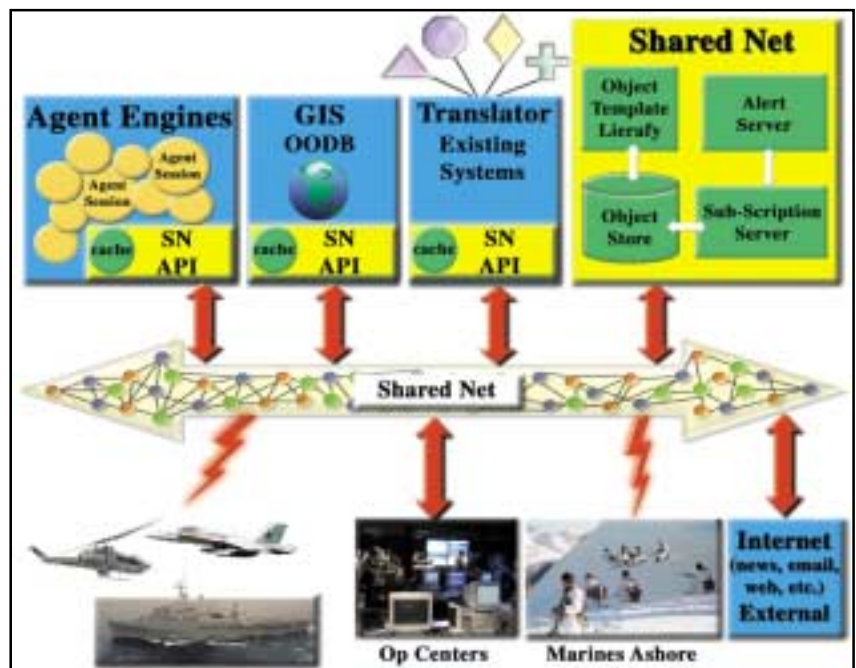
## Marine Corps MC 02 Objectives

The Marine Corps Service experimental objectives are as follows:

- **MOUT** - Evaluate and refine the draft Urban CAX program.
- **MOUT** - Refine the low-intensity urban warfare training program.
- **RSTA** - Develop, evaluate, and refine a draft RSTA coordination procedure that supports the tactical requirements of Marine Corps tactical forces conducting Urban CAX.
- **Logistics** - Assess potential solutions for integrating logistics command and control systems afloat employing intelligent agent technologies.
- **Logistics** - Sustain tactical units in contact in an urban environment.
- **C2IT** - Assess the ability of a candidate over-the-horizon/on-the-move (OTH/OTM) tactical communication system to support STOM.
- **C2IT** - Assess the ability of the Integrated Marine Multi-Agent Command and Control System (IMMACCS) to integrate battalion and below RSTA feeds into the Common Tactical Picture (CTP) and provide intelligent agent alert capability to battalion Command Operations Center (COC).
- **C2IT** - Assess the ability of IMMACCS to operate with existing battalion and below communications equipment, integrate Intelligence Operations System (IOS) functionality, provide an interface to higher headquarters, and operate in a secret environment.

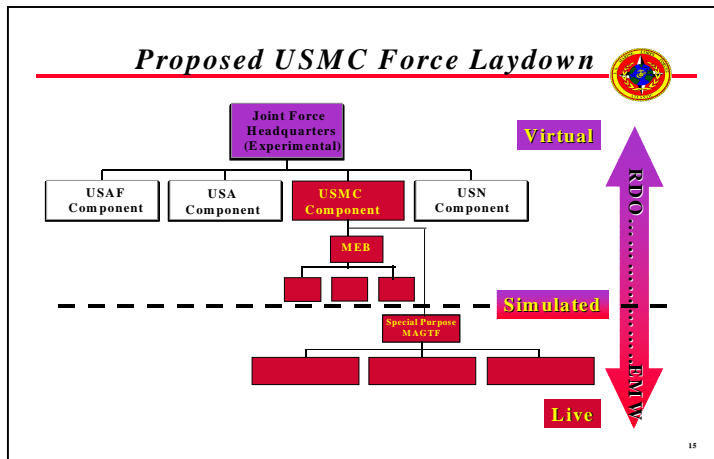


The products, customers, need documentation, and advocates that this experiment applies to are provided within the individual area of effort sections in this document (RSTA, C2IT, etc. noted next to the objectives above).



# EXPERIMENTATION CAMPAIGN PLAN -- 2001

31 May 2001



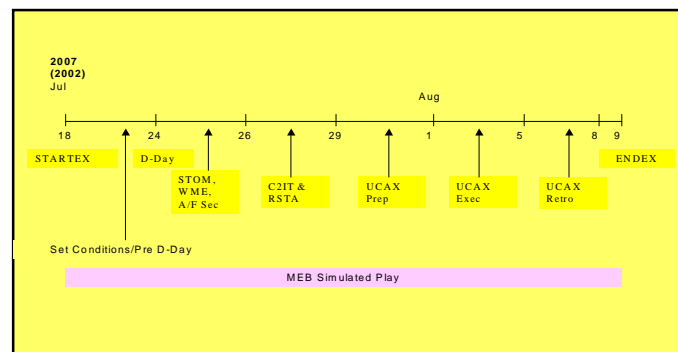
**Concept of Experimentation.** The Lab will execute its MC02 experimentation primarily in the western ranges of southern California, at George Air Force Base (AFB). In order to fulfill the JFCOM requirements for a demonstration of RDO 2007 capabilities during MC02, the Service experimentation at George and Camp Pendleton will be incorporated into MC02 to demonstrate the STOM concept.

## Command Relationships/Forces

The Marine forces for MC02 consist of a Service Component Headquarters (HQ) or Marine Force (MARFOR)/Joint Force Land Component Commander (JFLCC); a largely simulated Maritime Pre-positioning Force (MPF) (MPS-2) Marine Expeditionary Brigade (MEB) (1<sup>st</sup> MEB) represented by a response cell; two simulated Marine Expeditionary Units (MEUs) (11<sup>th</sup> and 26<sup>th</sup> MEU); the live STOM force (consisting of elements of the MEB); various Combat Support (CS), and Combat Service Support (CSS) elements; and an aggressor force (Operational Force (OPFOR)).

The STOM maneuver demonstration (24-26 July) will precede the UCAX (30 July-8

## MCWL MC02 Experiment Timeline



Aug), providing the means to move forces to George AFB to execute the UCAX.

The STOM maneuver will consist of an MV-22 (helicopter) borne rifle company conducting a vertical assault, and a company of Light Armored Reconnaissance (LAR) Light Armored Vehicles (LAVs) conducting a deep surface assault.

The LAR company will be brought ashore over Red Beach at Camp Pendleton via Landing Craft Air Cushion (LCACs) vehicles. Both assaults will be conducted into George AFB from amphibious shipping. Various reconnaissance assets will be in place prior to the STOM to provide en route intelligence concerning the adversary force



## MC02 Joint Force List

### Marine Forces

- |                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• <b>Required</b> <ul style="list-style-type: none"> <li>– MARINE FORCE HQS/JFLCC HQS</li> <li>– OPFOR</li> <li>– MPF MEB (SIM only)</li> <li>– 2 MEUs (1 UCAX, 1 SIM)</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• <b>Committed</b> <ul style="list-style-type: none"> <li>– MEB/MARFOR (Cmd Elem) (from II MEF)</li> <li>– Bn(-) (rein) (from I MEF)</li> <li>– Avn Cbt Elem (from I MEF)</li> <li>– Cbt SVC Spt (from I MEF)</li> <li>– 1 Co OPFOR (from I MEF)</li> </ul> </li> </ul> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

positions.

Upon arriving in George AFB, the STOM maneuver will continue with the Marine forces conducting airfield security operations to enable the insertion of an Army Interim Brigade Combat Team (IBCT). Upon insertion of the Army IBCT, Marine forces will conduct a link-up with the IBCT as it conducts a movement to the National Training Center (NTC) at Fort Irwin. At the NTC, the Army IBCT will join forces with an 82<sup>nd</sup> Airborne Battalion that has been providing security for the airfield operations.

Upon conclusion of the STOM maneuver, the Lab will transition to its C2IT/RSTA portion of the experiment (27-29 July), followed by the UCAX as indicated in the following timeline.

Throughout MC02, information will be provided, via the afloat MEB command

element (CE) or the Lab's Experiment Control (ExCon), to the Experimental Joint Force Headquarters (ExJFHQ) and MARFOR on the east coast so that situational awareness can be maintained via the CROP.

**Joint Operations** - Options for possible Army and USMC joint operations that will enable the execution of the missions discussed above include:

- Linkup at George AFB.
- Joint Army/Marine Corps operations in George AFB.
- Seizure and security of the airfield to allow for the arrival and employment of an Army force.
- Joint force withdrawal from the Joint Operation Area (JOA).



## *Command Element Initiatives*

End User Terminal	IV-CE-1
Integrated Marine Multi-Agent Command and Control System	IV-CE-2
Marine Communications Interface Module (Airborne)	IV-CE-3
MUBLCOM (Over-The-Horizon (OTH) Communications)	IV-CE-4

## End User Terminal

**Purpose:** Explore potential solutions for End User Terminals (EUT) for the foot mobile Marine.

**Background:** Since Hunter Warrior initial experimentation using an Apple Newton as a tactical palm-top computer, the Lab has pursued a variety of commercial alternative End User Terminals as tactical palm-top computers. The requirement for a computer is implicit in our operating concepts that are information based and require digital entry into and out of the emerging Common Tactical Picture whether as currently configured on TCO, C2PC, or experimental systems such as IMMACCS. The requirement is reflected in the DACT ORD and experimentation into the user requirements at various tactical levels is of particular interest to MARCORSYSCOM Program Manager, Information Systems (PM IS).

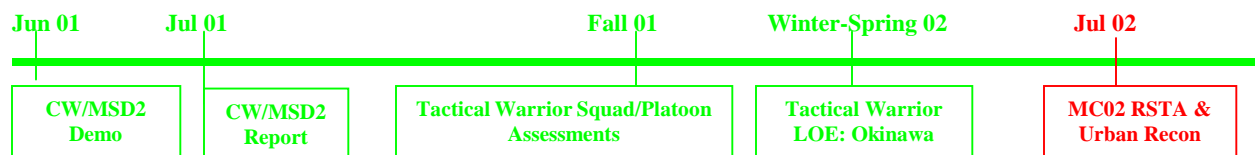


### Description:

- Wearable computer, integrated into MOLLE vest
- Integrated GPS
- Pentium III processor
- 6 ft submersible
- WAVELAN communications capability
- Speech Recognition for hands-free operation
- Experimenting with Palm-type devices in addition

**Deliverable Product(s):** Report of *Capable Warrior* assessment; 24 prototype wearable EUTs for follow-on experimentation with *Tactical Warrior* experiments.

### Milestones:

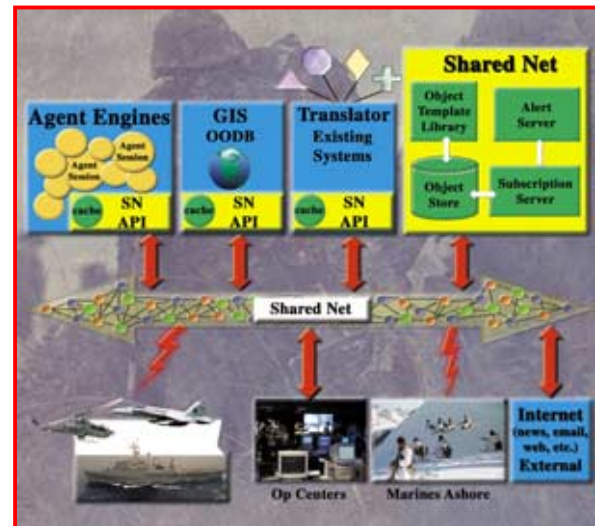


Action Officer: Major Rick Lykins 784-1333

## Integrated Marine Multi-Agent Command and Control System (IMMACCS)

**Purpose:** Develop an advanced, object-oriented, agent-based command and control system to enhance the commander's ability to make decisions and manage the Battlespace; provide the capability to synchronize data across currently fielded command and control systems with on-demand access to vital intelligence, fire support, aviation, logistics, and force protection information via an object-serving and subscription-based communication facility called the Shared Net.

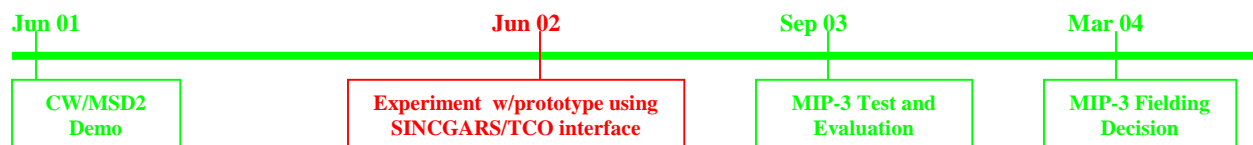
**Background:** IMMACCS is a near real-time decision support application that uses the Integrated Collaborative Decision Model (ICDM) framework as an underlying architecture. Acts as a *system of systems* in which computer-based agents and human users, with very different but complimentary capabilities, interact to solve problems collaboratively. Different types of agents, with the ability to recognize objects and the relationships between objects, catalog and file this information into *folders* for use by the command staff. IMMACCS was an integral part of the Experimental Combat Operations Center demonstrated by the Extending the Littoral Battlespace Advanced Concept Technology Demonstration's (ELB ACTD) Major Systems Demonstration 2 conducted in conjunction with the Lab's *Capable Warrior* Advanced Warfighting Experiment in June 2001.



**Description:** Object oriented database represents all battlefield entities as objects, with attributes and interrelationships. Intelligent software agents examine battlefield objects and relationships, provide alerts to operators: Blue on Blue, ROE violations, appearance of threat, NAI/TAI. Advanced 3D visualization tool. Translator interfaces to other command and control systems. Elements of this system are candidates for technology insertion into Programs of Record supporting TCO, IAS approach to dynamic, adaptive, and decision support tools.

**Deliverable Product(s):** Intelligent software and lessons learned during integration and experimentation of adaptive command and control passed directly to MARCORSYSCOM SE&I, PM OC and Decision Support Systems FNC.

### Milestones:

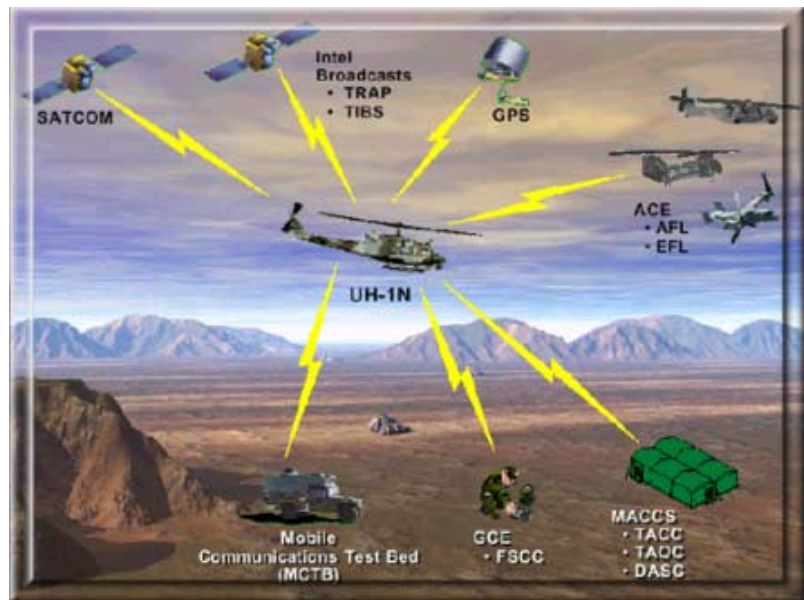


Action Officer: Major Rick Lykins 784-1333

## Marine Communications Interface Module (Airborne)

**Purpose:** To develop an advanced airborne command and control platform to allow the maneuver commander to have voice communications, digital communications, and common tactical picture in a heliborne configuration

**Background:** This initiative supports the Marine Airborne Command and Control Console UNS (Draft) and a program of record under MARCORSYSCOM PM OC. This system is expected to be funded during FY04 provided it successfully proves its value during limited operational assessments conducted in collaboration with the Lab.

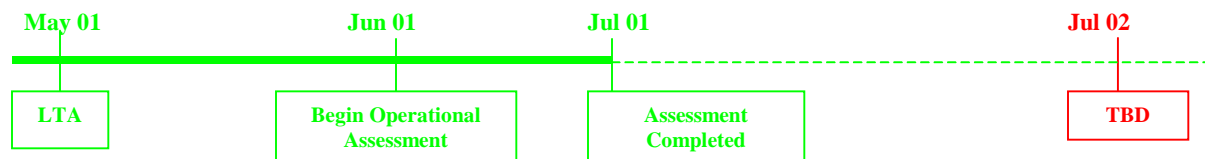


### Description:

- Uses a surrogate JTRS software defined radio
- Supports SINCGARS, UHF, VHF, narrowband SATCOM
- Data capability using SINCGARS and SATCOM provides ground C2PC picture to the airborne platform.
- Supports 4 radio channels simultaneously.

**Deliverable Product(s):** Assessment of a Prototype MCIM (A) for UH-1N platform

### Milestones:



Action Officer: Major Richard Hardin 784-1331

## MUBLCOM (Over-The-Horizon (OTH) Communications)

**Purpose:** Investigate OTH communications systems capable of linking tactical maneuver units, platforms and fire support assets with the command elements in support of Expeditionary Maneuver Warfare (EMW).

**Background:** Since *Hunter Warrior* the Lab has experimented with command and control concepts involving OTH communication systems to connect expeditionary operating forces ashore with the seabase and the Joint Force Commander. Experimentation continued through *Urban* and *Capable Warrior*, as well as the Extending the Littoral Battlespace Advanced Concept Technology Demonstration. The envisioned system must provide assured access at all levels, on-the-move capability, tactical level security, and a robust network that does not need ground-based infrastructure. The system must make efficient use of the UHF spectrum and support improved situational awareness at all levels of functionality. The requirement is addressed in the EMW Tactical Communications Relay UNS.



**Description:** The Lab has conducted proof of concept experiments with a variety of approaches to the problem. In addition, to the ELB ACTD WarNet system, the Lab has reviewed the utility of both Multi-Path Beyond Line of Site Communications (MUBLCOM) and Marine Communications Interface Module (Airborne) systems. The MUBLCOM concept is based upon a constellation of LEO or MEO satellites providing a point-to-point, all informed capability to mobile users within a 400-mile footprint. It is LPI, LPD and uses AJ waveforms, in UHF frequency that provides up to 16 kbps data, good foliage penetration, and good urban performance. It has the capacity to provide doctrinal circuits to fulfill MEF netted communications requirements. Un-funded cost and operation of the complete system including the satellite constellation is an estimated \$1.2 billion.

**Deliverable Product(s):** Report of MUBLCOM assessment to UNS Analysis of Alternatives (AOA)

### Milestones:



**Action Officers:** Lieutenant Colonel Nick Cusack, RM and Captain Jake Falcone 784-1333

*Aviation Combat Element Initiatives*

Advanced Close Air Support System (ACASS)  
Common Assault Support Crew Served Weapon  
Rotary Wing Survivability

IV-ACE 1  
IV-ACE 2  
IV-ACE 3

## Advanced Close Air Support System (ACASS)

**Purpose:** A digital transmission system designed to increase a FAC's situational awareness and enable adverse weather close-air support. The system provides a continuous display of the aircraft's groundtrack to the Forward Air Controller (FAC).

**Background:** The Lab is collaborating with MARCORSYSCOM TLDHS Program Manager in developing a material solution to the TLDHS ORD, DACT PM for a material solution to the DACT ORD through ACASS operational experimentation.

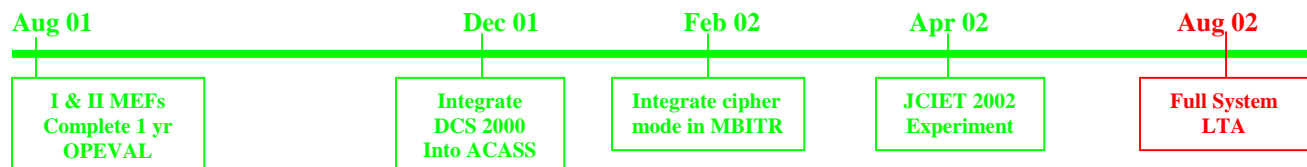
**Description:** ACASS is composed of a ruggedized hand-held computer (RHC) currently being purchased through MARCORSYSCOM. . FAC equipment also includes a laser range finder. During assessments, all work has been done with the Automated Target Hand-off System (ATHS) in an AV-8B Harrier. Provides for precise targeting, digital data transmission requiring no pilot data entry, and continuous visual presentation of aircraft ground track Software is combined with the RHC and a radio to digitally plan, transmit, and terminally control a CAS mission. Changes in software are pending to upgrade to NT compatible with DCS communications system.



**Concept of Experimentation:** Experimentation is continuing and the system appears promising. Development in '01 will include the integration of a precision targeting device to support reconnaissance, surveillance and target acquisition missions and Military Operations in Urban Terrain (MOUT). Operational evaluations with I MEF & II MEF and Limited technical assessments for integration of MELIOS [Mini Eyesafe Laser Infrared Observation Set] Precision Targeting Device and MBITR [Multiband Inter/Intra Team Radio (AN/PRC-148(V)(C)) with Ruggedized Handheld Computer [RHC] will be conducted in 2001.

**Deliverable Product(s):** 40 sets of improved ACASS software; operating force assessment of improved ACASS software; an updated UNS.

### Milestones:



Action Officer: Mr. Bill Scheffler 784-3208

## Common Assault Support Crew Served Weapon

**Purpose:** To examine the weapon as a possible weapon common to all rotary wing assault support assets.

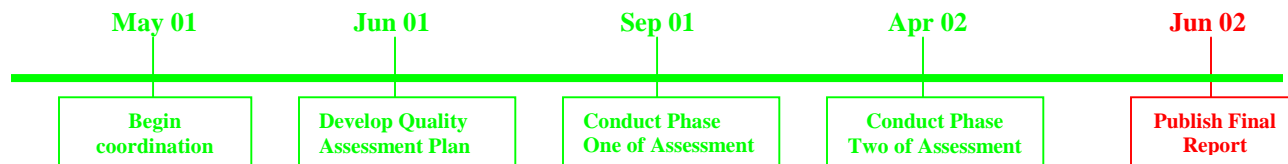
**Background:** The Marine Corps Rotary Wing Operational Analysis Group (OAG) has continually listed the lack of a common crew served assault weapon as one of its top ten priorities. In an effort to address this gap in capability, MCWL has initiated efforts to examine the effectiveness of the M3M Pintle Weapon System (PWS). The weapon is designed and manufactured by FN Herstal. The M3M is a .50 caliber weapon designed specifically for employment on vehicular and aviation assets. The weapon achieves a high rate of accurate fire through several innovative features. The single barrel of the weapon is chrome-plated stellite allowing the weapon to sustain a rate of fire of 1100 rounds per minute. Another feature of the weapon is an open-bolt system that virtually eliminates cook-off problems. The medium pintle head (MPH) was integrated into the weapon as a soft mount to provide high recoil attenuation. The reduced recoil forces allow for greater first round accuracy and the ability to maintain effective suppression on the target without difficulty.



**Description:** The assessment for the M3M PWS will be a two-phased assessment conducted at MAWTS-1 as part of their bi-annual weapons and tactics instructors (WTI) course. The initial phase of the assessment will take place in Sept 2001. During this period the M3M will be installed onboard several UH-1N "Huey" helicopters for testing. The second portion of the assessment will take place in Yuma during March-April of 2002 as part of the spring WTI course. This portion of the assessment will examine the weapon system onboard the CH-46E "Phrog" and the CH-53E "Super Stallion" aircraft. Conducting the assessment at MAWTS-1 enables us to take advantage of vast range of mission profiles flown as part of WTI. The weapon will be fired in all flight regimes and under all light conditions, lending more credibility to the data produced from the quality assessment.

**Deliverable Product(s):** Quality Assessment Plan for each phase of the test detailing the performance of the M3M weapon system onboard assault aircraft.

### Milestones:



**Action Officer:** Captain A.J. Butler 784-3785

## Rotary Wing Survivability

**Purpose:** To solve critical warfighting issues related to conducting effective assault and close air support in the urban environment.

**Background:** Both *Hunter* and *Urban Warrior* highlighted the need to improve the survivability of assault support and attack helicopters. Although survivability issues are not limited to the urban environment, the Lab will concentrate on survivability in built-up areas for several reasons. Little is known about urban RW aviation operations, in part due to limited training ranges and the lack of urban training in fleet units.

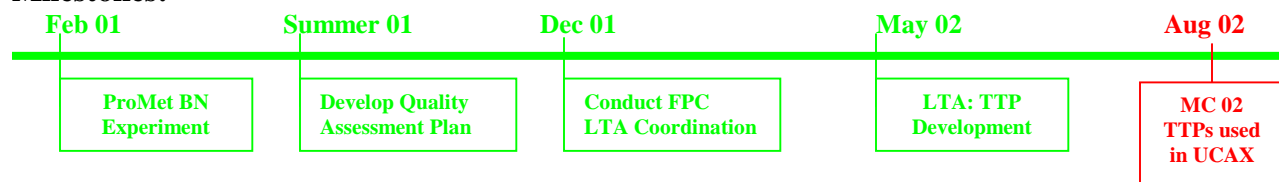


Another ongoing effort at the Lab is the Yodaville Urban CAS range at MCAS Yuma which will be the venue for the a rotary-wing LTA in FY '02. Data from the ProMet experiment conducted in Feb '01 indicated that RW aircraft can survive in the urban environment with the right training and tactics. In addition to survivability, the ProMet experiment examined other facets of urban operations. These facets included position marking, combat identification, and CAS procedures. The assessment indicated that a variety of technology options as well as TTP improvements may have utility in improving survivability.

**Description:** The Lab will conduct an LTA in FY '02 that will focus on rotary wing operations in the urban environment. TTP development will build off the experience of the *Project Metropolis* Mid-High Intensity Battalion experiment conducted in February 01 in the *Desolate City* facility at the former George AFB and the Urban CAS Assessment conducted by MAWTS-1 at Yodaville MCAS Yuma, AZ. The LTA is FY '02 will utilize rotary wing assets from 2d and 3d MAW, and possibly TF 160<sup>th</sup> (SOAR). Experiments will use seeker vans from Missile and Space Intelligence Center (MISC) and Naval Surface Warfare Center (NSWC) Crane Division. in order to employ virtual manpads against helicopters thereby providing comparative data on the survivability of those assets. Experimentation will be conducted using remote marking devices, which will enable us to examine the effectiveness of danger close CAS in the urban environment

**Deliverable Product(s):** Comprehensive report detailing findings and data as well as recommended improvements in TTP.

### Milestones:



Action Officer: Captain A.J. Butler 784-3785

## *Ground Combat Element Initiatives*

Alternate Power Source	IV-GCE-1
Automatic Lightweight Grenade Launcher (STRIKER)	IV-GCE-2
Camp Lejeune Combat Assault Range	IV-GCE-3
Combat Decision Range (CDR)	IV-GCE-4
Combat Identification & Situational Awareness	IV-GCE-5
Dragon Eye Unmanned Aerial Vehicle	IV-GCE-6
Dragon Warrior Unmanned Aerial Vehicle	IV-GCE-7
Enhanced Reconnaissance Team	IV-GCE-8
Mobile Ground Sensors --Dragon Runner	IV-GCE-9
Intra Platoon Radio	IV-GCE-10
M4 Modular Weapon System Assessment	IV-GCE-11
Mobile Counterfire System (MCFS)	IV-GCE-12
Mobile Fire Support System (MFSS)	IV-GCE-13
Mortar Ballistic Computer	IV-GCE14
Night Integrated Training Environment (NITE Lab)	IV-GCE-15
Precision Target Acquisition, Mobile (PTAM)	IV-GCE-16
Reconnaissance, Surveillance, Targeting Acquisition	IV-GCD-17
Tactical Warrior	IV-GCE-18
Unattended Ground Sensors	IV-GCE-19
Universal Combined Arms Targeting System (UCATS)	IV-GCE-20
Urban Range Instrumentation	IV-GCE-21
Urban Combined Arms Exercise (UCAX)	IV-GCE-22

## Alternate Power Source



**Purpose:** Develop an Alternate Power Source to power the AN/PRC-119 SINCGARS Radio (and radios of similar power requirements) for Fleet Marine Reconnaissance Units.

**Background:** The single greatest limiting factor in the mobility and operating time in the field for reconnaissance units is the weight and service life of current power sources for radios and RSTA technologies. Alternatives are needed that are

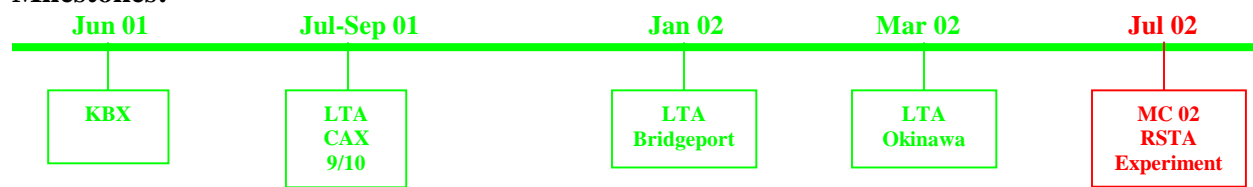
lightweight, quiet and affordable. The objective is to reduce the Recon Marine's load and battery requirement by developing a power source that reduces the combat load and yields or exceeds the power densities of the current battery technology (BA-5590 and the BB-390). This initiative supports the *Alternate Power MNS*.

**Description:** Zinc-air batteries use oxygen from the atmosphere to react electrochemically with alkaline zinc anodes similar to those found in alkaline batteries (e.g. Duracell, Energizer), making them very lightweight, safe, and low cost. The air is drawn into the battery case and circulated through it via a small direct current fan powered by the battery, so that full power is achieved even when the battery is packed into a rucksack. Since the zinc-air battery is larger than a BA-5590 battery, there is an electrical interface the size of the BA-5590, which fits into the battery compartment of the radio-transmitter, and this is connected to the zinc-air battery via a retractile cord. Connection of the cord to the zinc-air battery energizes the fan. The model FC zinc-air battery weighs 5.5 lbs, versus 2.2 lbs. for the BA-5590, but delivers the equivalent capacity of five BA-5590's, powering an AN/PRC-119B or AN/PRC-119F for five to nine days depending on usage. Once in automated production it will deliver electrical power at a cost of about 15-20 cents per watt-hour, versus 42 cents per watt-hour for the BA-5590.

The Marine Corps Warfighting Laboratory in conjunction with the Army's CECOM's Fuel Cell Technology Team, Fort Monmouth, NJ, will evaluate the Zinc-Air fuel cells, assess and document fuel cell performance (technological maturity, size, weight, and cost) in comparison to current SINCGARS battery and other candidate power source technologies, and deliver a prototype fuel cell power source for field experimentation.

**Deliverable Product:** Prototype Zinc-Air fuel cell power source that shows advantages over current SINCGARS battery technology in size, weight, and cost.

## Milestones:



Action Officer: Major Greg Heines 784-0056

## Automatic Lightweight Grenade Launcher (STRIKER)

**Purpose:** Provide firepower for infantry with greater lethality and minimized logistical burden than current crew-served systems.

**Background:** The Lab began experimentation with the Striker on behalf of the MARCORSYSCOM Ground Weapons Program Manager to assist in providing operational assessment by the operating forces.

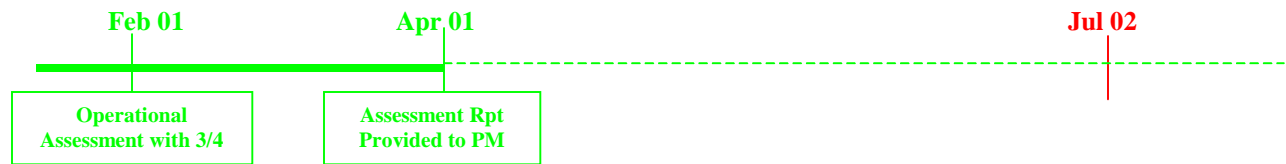
**Description:** The STRIKER is a prototype 40-mm grenade machine gun that is a lightweight, low-recoil weapon with ammunition that can be programmed for airbursts. It is outfitted with a computer processor and laser range finder that provides a fire solution. Marines will use this system in all operational environments.

The Lab developed an experimentation plan that involved live fire assessment at MCAGCC 29 Palms and a follow-up urban assessment during an on-going urban experiment at the former George AFB.



**Deliverable Product(s):** An assessment report was provided to the MARCORSYSCOM Ground Weapons Program Manager. No further experimentation is planned at this time. Congressional enhancement is pending.

### Milestones:



Action Officer: Maj Lance McDaniel 784-3425

## Camp Lejeune Combat Assault Range

**Purpose:** To develop an instrumentation package for company assault range to use as a test bed for instrumentation efforts.

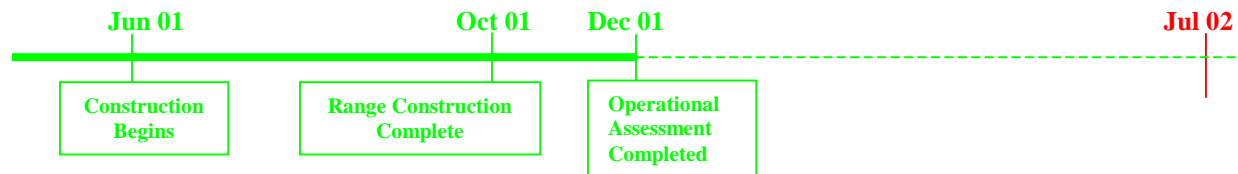
**Background:** *Urban Warrior* and the initial training assessments conducted as an integral part of Project Metropolis experimentation indicated a training facility deficiency to adequately conduct combat assaults. In coordination with Training and Education Command, MARCORSYSCOM, and 2d Marine Division – on behalf of the GCE Advocate – the Lab is supporting the construction of a prototype combat assault range at Camp Lejeune, NC.



**Description:** The Combat Assault Range will include both a maneuver facility and a deployable range system for collecting data as to the effectiveness of the TTPs of the using operational force. The intent is to identify a deployable data collection system that can be used in supporting experimentation as well as conducting after action reviews for the benefit of the operating forces.

**Deliverable Product(s):** Deployable range system

### Milestones:



**Action Officer:** Lieutenant Colonel Colin Beadon, RM 784-3785

## Combat Decision Range (CDR)

**Purpose:** To provide a portable, easy to use, training tool to assist the operating forces in developing decision-making and situational recognition of small unit leaders.

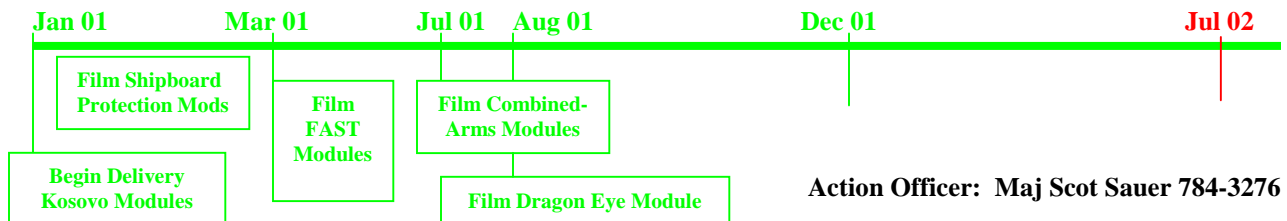
**Background.** The CDR is intended to be a rifle range equivalent for the mind. It is a computer assisted training tool intended to be used by a unit leader to train his subordinate tactical leaders in making combat related decisions by learning to recognize a particular real scenario before it actually occurs. The trainees must make operational decisions, reacting to the video events and to the shouts and commands by members of their unit in the room with them. The goal is to force immediate decisions under pressure, so that the trainee gains confidence and builds up a repertoire of virtual experiences from which to draw when confronted suddenly by the real thing. The trainee learns by recognizing certain precursor actions that will most probably lead to follow-on cascading events, just as a pilot learns in a flight simulator. The scenarios are designed for leaders, not shooters. Most decisions by a leader have to do with positioning, planning, maneuvering and giving the proper orders for others to execute in order to prevent cascading events from degenerating into chaos. Only a small minority of decisions relates to shooting a person. The focus is not upon "shoot, don't shoot" vignettes. The CDR is broader and at a higher level and involves not only recognizing the events that require a decision, but also how to implement the decision by either providing direction to his subordinates or in clearly articulating the situation to higher or adjacent commanders.



**Description:** The CDR is a series of scenario modules on CD-Rom capable of being operated by the unit leaders with a minimum of advance familiarization. The CDR was initially field tested with 1<sup>st</sup> Battalion 5<sup>th</sup> Marines prior to Urban Warrior. It was briefed to the GCE Board in December of 1999 and at the request of the board, the Lab fielded systems to every active duty infantry regiment, a reserve mobile training team, and to both Schools of Infantry. Subsequently, it has been field tested with several deployed MEUs specifically BLT 3/8 prior to their entry into Kosovo. As a result, specific modules have been developed in collaboration with the operating forces geared to peacekeeping/peace enforcement and other ambiguous scenarios typical of those faced by MEUs.

**Deliverable Products:** Five new modules per year developed and delivered to the operating forces.

### Milestones:



## Combat Identification & Situational Awareness for Dismounted Combatants

**Purpose:** Identification and location awareness of friendly dismounted combatants by other dismounted combatants is an area of particular concern in the projected MOUT of future military engagements. This task addresses that concern by evaluating systems that provide the Marine with the ability to actively query unknown persons and receive a response from a similarly equipped combatant and/or systems that provide awareness of the location of other Marines within a squad or other squads.

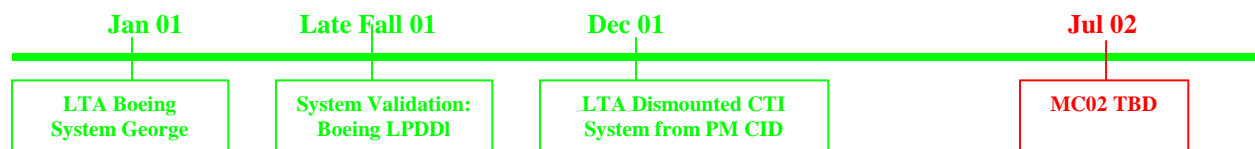
**Background:** There is a Combat Identification Mission Needs Statement and a MARCORSYSCOM Program Manager (M. Craig Pritzger). Current capability consists of a rifle mounted system based on a laser request and radio frequency return, with GPS based centralized tracking system. Final delivery from Boeing is expected in July 2001. Motorola is developing a similar system for the U.S. Army. The Lab will receive a set of thirteen for experimentation when Army acceptance testing is complete. Of note is that this is an ongoing effort with several technologies and is not one technology working alone. Transition strategy involves finding a mature technology that meets operational needs as they are evolving.

**Description:** A rifle mounted laser illuminator and display is part of the system. The laser is used to query the unknown person. The display indicates if a friendly response is received. Laser sensors are mounted on the helmet and a web harness system. The sensors signal the main controller to generate a response signal when a friendly laser is detected. The main controller also provides a location signal to a central monitoring computer. Location is based on a GPS receiver mounted on the web system. The central monitoring computer can overlay team locations on a two-dimensional map of the operation area.



**Deliverable Product(s):** Transition products include both a refinement of needs (anticipate submission of an UNS) and equipment (as appropriate).

### Milestones:



Action Officer: Major Lance McDaniel 784-3208



## Dragon Eye Unmanned Aerial Vehicle

**Purpose:** Provide a Marine small unit leader with an organic UAV capable of conducting over-the-hill/over-the-next-building surveillance, and reconnaissance.



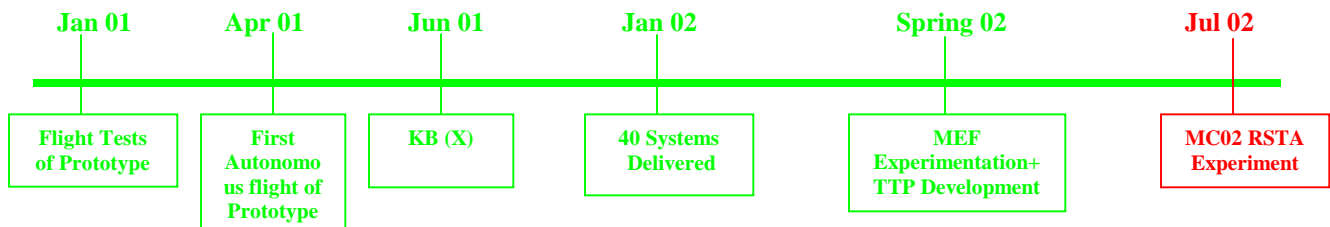
**Background:** The impetus for the project came from the Secretary of the Navy's Over-the-Hill Reconnaissance initiative and the Interim Small Unit Remote Scouting System requirement. This UAV is intended to support MARCORSYSCOM to develop a prototype lightweight, backpackable UAV capable of providing real time day/night video imagery. The MARCORSYSCOM, PM Scouting Systems is the office of record and the ISURSS (Interim Small Unit

Remote Sensor System) is a sub-requirement of the Tactical Remote Sensor Suite ORD.

**Description:** Dragon Eye is a 4.5-pound, battery-powered, modular UAV capable of fully autonomous flight. Made of lightweight Kevlar material, this system is designed to disassemble into five separate pieces, and intended to be carried in an individual Marine's ALICE pack. Missions are programmed via a wireless modem that is integrated into a ten-pound wearable ground control station. After being hand launched, Dragon Eye flies to pre-assigned GPS waypoints via an onboard autopilot, which has the ability to be reprogrammed in flight. Its sensors include full motion color, low light black and white, and infrared cameras, each having the capability to transmit a video LOS to a range of ten kilometers. Dragon Eye flies up to speeds of 45 kts, and has a battery endurance of sixty minutes.

**Deliverable Product(s)** Jan 02: (20) Dragon Eye Systems (40 aircraft, 20 Ground Control Stations) for MEF experimentation Feb-May 02.  
Late FY02 or early FY03: Milestone "C" Decision / Fielding, initial procurement of 1000 aircraft and 200 Ground Control Stations.

### Milestones:



Action Officer: Major Sugar Cane 784-6413

## Dragon Warrior Unmanned Aerial Vehicle

**Purpose:** Provide an over-the-horizon wide-band receiver/transmitter communications relay as well as a reconnaissance, surveillance and precision targeting capability to a Marine Expeditionary Unit/Regiment/Division.

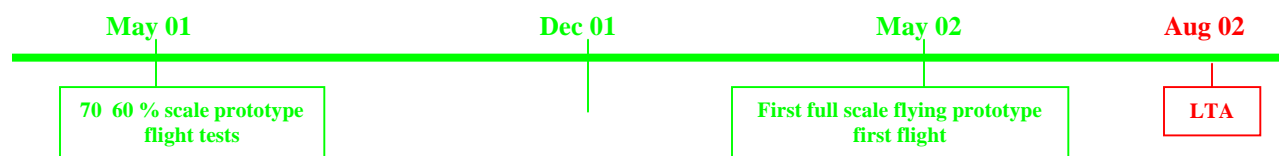
**Background:** *Hunter Warrior* and *Urban Warrior* experimentation highlighted the need for a more capable UAV for use on the extended battlefield. Use as an in extremis communications relay permits the force commander to place a relay over the battlefield when there are intervening obstacles to interrupt line of sight communications. In addition, the value of a ubiquitous RSTA platform for a variety of sensors that can provide near real time data from the battlefield is essential to our emerging concepts of *Operational Maneuver From the Sea* and *Ship-to-Objective Maneuver* by providing an additional node on both the emerging Naval Expeditionary Sensor Net and in support of the Joint Force Commander's battlespace collection requirements. This initiative is a technology candidate for meeting the Close Range UAV Requirement.



**Description:** A fully autonomous vehicle being developed by the Lab and the Naval Research Lab (NRL). Current specifications call for the UAV to have a fuselage of approximately 7 feet. The rotor will be approximately 8 feet in length. *Dragon Warrior* is being designed to have a maximum speed of 110 knots, a range of 50 nautical miles and an endurance of three to five hours depending on the mission profile, with one hour loiter ability at 75 km from launch point. It will be fully shipboard compatible and employ a *heavy* fuel engine. The UAV will have a maximum gross weight of 230 pounds. Payload weights will vary between 25 and 35 pounds depending on the mission profile. It will be equipped initially with an EO/IR sensor with laser range finder, with future upgrades to a laser designator. The flight profile is intended to operate fully autonomously; while the payloads are controlled via a HMMWV mounted Ground Control Station. The entire system, aircraft and data link hardware will fit into a single HMMWV.

**Deliverable Product(s):** Three Full Scale Flying Prototypes

**Milestones:**



**Action Officer:** Major John Cane 784 6412



## Enhanced Reconnaissance Team

**Purpose:** Develop a lighter more capable Reconnaissance Team in order to provide the supported commander with timely accurate information across the operational spectrum.

**Background:** The objective is to enhance the Reconnaissance Team's capabilities by developing a mission planning system, reducing the weight of the combat load, increase their standoff from enemy forces while experimenting with Commercial Off

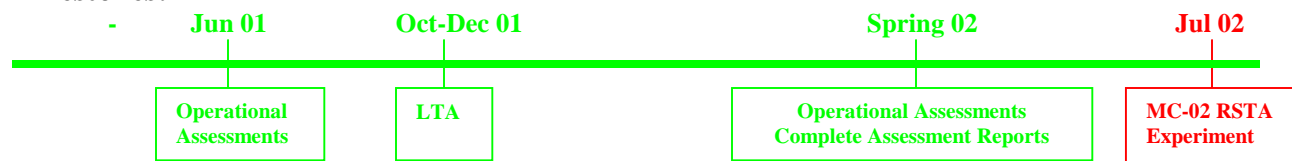
The Shelf (COTS) items. The effort is designed to explore the potential for Commercial Off The Shelf (COTS) items provide or enhance the following capability needs within our reconnaissance units:

- **Mission Planning**
- **Communications**
- **Fuel Cells**
- **Imagery Transfer**
- **Spotting Scopes**
- **Remote Observation Sensors**
- **Improving MP SIDS**

**Description:** Reconnaissance Units will evaluate a mission planning system, tactical radios, rugged handheld computer, PDA's, digital cameras, wireless day / night surveillance camera system while utilizing current equipment as a baseline. Instructor support from the Scout Sniper Schools -- will evaluate and assess the improved spotting scopes utilizing current equipment as a baseline.

**Deliverable Product:** By July 2002, the Enhanced Recon Team will be able to conduct proof of concept level experimentation during the Millennium Challenge Joint Experiment. Utilizing this technology will reduce the combat weight and increased the supported commander Situational Awareness on enemy forces

### Milestones:



Action Officer: Major Gregory Heines 278-0056

## Intra Platoon Radio



**Purpose:** Explore options for secure communications between the Platoon Commander and Squad Leaders.

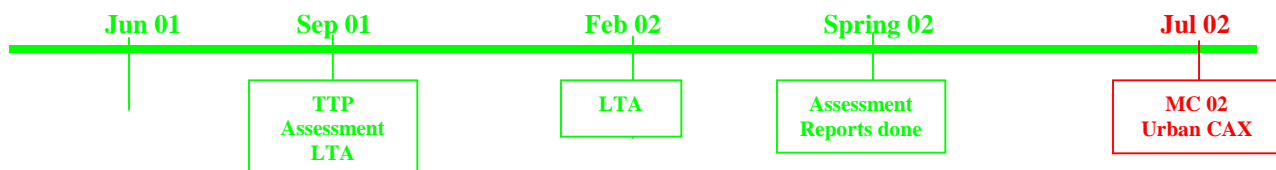
**Background:** During *Urban Warrior* and subsequent experimentation with new tactics, techniques and procedures for urban operations during *Project Metropolis*, the requirement for a dependable, secure communication means between Platoon Commanders and their subordinate elements has been repeatedly identified as a deficiency. The Intra Squad Radio (ISR) initiative was expanded as a stopgap measure to provide non-secure communications between the platoon and their squad leaders. However, during experimentation and early assessments in pre-deployment training, operating units identified deficiencies in using an “non-secure” ISR

**Description:** The requirement is for a secure (Type 1 encrypted) handheld VHF radio with the ability to integrate with insecure ISR and secure SINCGARS. The possibility of UHF access in the same radio

would provide a potential additional capability in coordinating directly with aircraft. MCWL will conduct an assessment of COTS radio capability and options beyond the ISR involving experimentation with candidate radios during *Project Metropolis* Block 2 Program. Many current radios could meet the requirement; however, the Racal MBITR (PRC 148) is already being fielded to the Platoon level and could be a logical initial test case since adoption would constitute an expansion of a current acquisition system rather than a new start. Initial estimate of the expanded requirement is 1664 radios for an estimated cost of \$9.5 million. Experimentation must determine whether IPR should be integrated with ISR. It also must determine if integration is beneficial, via what mechanism, and the impact on TTP. In addition, insights into potential logistics and manning issues with the expanded density of radios must be explored through experimentation.

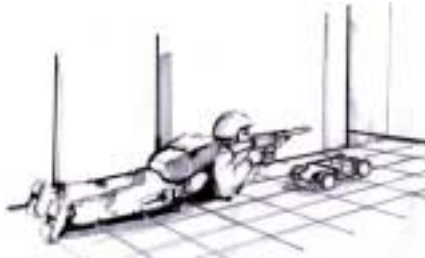
**Deliverable Product(s):** Report on benefits of a secure communications at Platoon/Squad level and recommendations on suitable radio, scaling and integration with ISR. Inform JTRS requirements.

### Milestones:



**Action Officer:** LtCol Nick Cusack RM, Capt Jake Falcone 784-1335

## Mobile Ground Sensors --Dragon Runner



**Purpose:** To develop ground mobile sensors for use by Marine infantry battalions that have the capability to perform autonomously and cooperatively in providing real-time information directly to the user in multi-purpose operational venues in urban combat conditions.

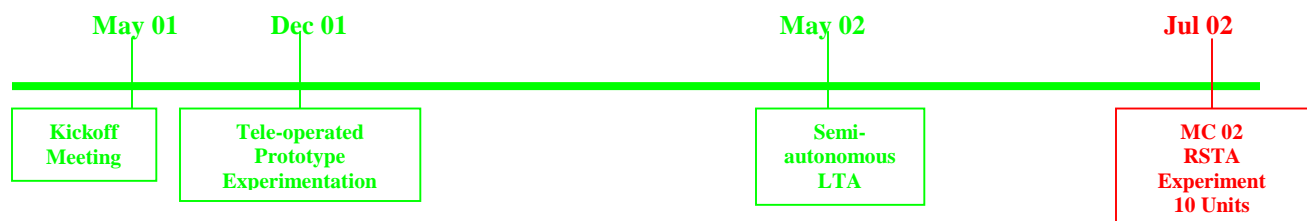
**Background:** This project's intent is to fulfill requirements identified by the Universal Needs Statement (UNS) drafted by the Lab and forwarded to MCCDC in support of the Lab's RSTA Project. There are several existing ORDs that may be impacted through technology insertion: UGV, Man-pack, SIDS, and TRSS. The primary candidate under consideration is a small, mobile chassis under development by Naval Research Lab (NRL), in conjunction with Carnegie Mellon Robotics Lab.

**Description:** Initial prototype ground vehicle is intended to have the following characteristics:

- Semi-autonomous operation
- Maximum Gross Weight of 10 lbs – Goal of less than 8 lbs.
- Maximum Vehicle Size of 8"X8"X6"
- Endurance of 2 hrs moving, 12 hours stationary (sentry)
- Sensors – Video/Audio/Motion
- Clear LOS Range of at least 200 meters
- Reliable Link range of at least two turns indoors
- Rugged, small, lightweight, GCS compatible with the Dragon Eye GCS
- Inexpensive (under \$500.00 each in quantity of 1000)
- Transition-able through MARCORSYSCOM

**Deliverable Product(s):** Prototype system(s). These systems will potentially serve as baseline concept demonstrators for the material developer (UGV Joint Program Office) should a material acquisition be formally sought.

### Milestones:

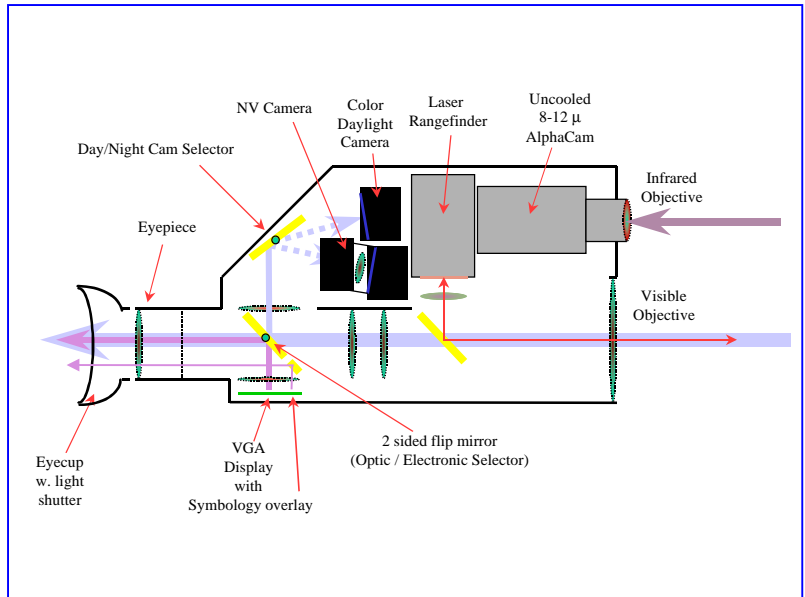


Action Officer: Maj. John Cane 784-6413

## M4 Modular Weapon System Assessment

**Purpose:** To assist the GCE Advocate in conducting an operational assessment of the potential utility of adopting the M4 Modular Weapons System as the primary combat system for Marine infantry of the future.

**Background:** The M4 Modular Weapon System (MWS) Assessment is sponsored by the GCE Advocate as an V32 evaluation of the *reflex* day optic for the M4/M4A1 MWS.. As stated in Annex C of the GCE Campaign Plan 2001 (PP&O), a replacement for the current Service Rifle will be required in the long-term (FY-08 and beyond). The Lab is conducting this assessment as an integral part of *Project Rifleman*. The Lab drafted the Assessment Letter of Instruction (LOI) for 2d MarDiv, coordinate and supervise all planning conferences and in-progress reviews, provided technical liaison support, and is helping to coordinate the conduct of the assessment. The

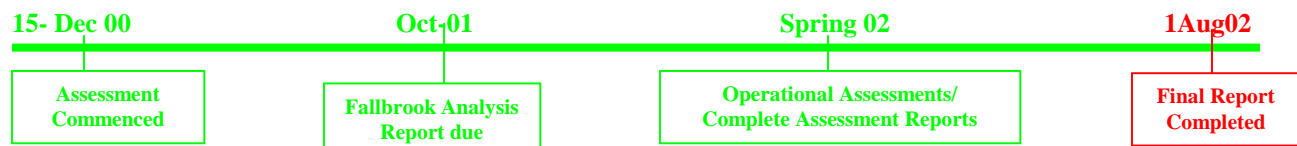


overarching goal of the assessment is a coordinated, assessment involving the Advocate, the Lab, the Marine Corps Operational Test and Evaluation Activity (MCOTEA), Marine Corps Systems Command (MCSC), Training and Education Command (TECOM) Weapons Training Battalion (WTBN), and Marine Corps Combat Development Command (MCCDC) Requirements, that can result in sufficient data to support acquisition decision making based on the operational merits of the M4 and M4A1 Modular Weapon Systems (M4 MWS).

**Description:** The M4 MWS Assessment is of the *Reflex Optic*, rail-mounted tritium illuminated, non-magnified day optic will allow for the rifleman to more rapidly engage targets from 300m or less and allow for the simultaneous transition to iron sights for 300-500m targets. The M4 MWS Assessment is a Battalion-sized effort employing V32. Multiple training events, including environmental training and multiple live-fire events, will be conducted under the close observation of MCOTEA and supported by the GCE Advocate, the Lab, MARCORSYSCOM PM Infantry, and Training & Education Command's Weapons Training Battalion.

**Deliverable Product(s):** Final Report: an Operational Assessment of the *Reflex Optic*.

### Milestones:



**Action Officer:** Captain Tim Walker 784-3785



## Mobile Counterfire System (MCFS)

**Purpose:** Develop a counter sniper system that can improve force protection in urban settings. MCFS will augment force protection by providing a capability to immediately detect sniper fire, identify the location from which a sniper is shooting, and --depending on the system configuration -- to return accurate fire.

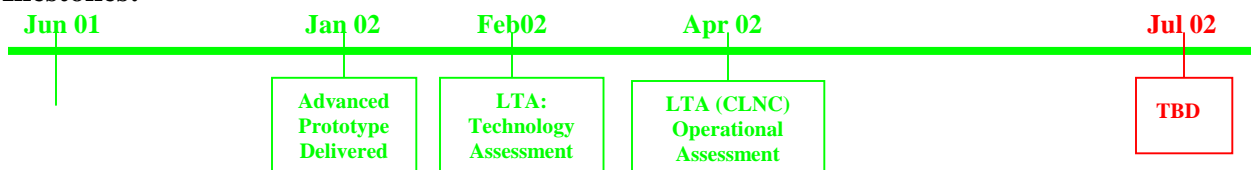
**Background:** This is a work in progress with very new and developmental technology.

Technological advances in acoustic sensors, computer analysis of sound signatures, and integration of robotics will produce sniper detection and counter-sniper prototypes that could be feasible to develop and mature as products for fielding to operational forces in the short term. Long-term intent is to migrate parts of the technology (especially the sensor package) to other Program of Record vehicle platforms. Transition to Programs of Record depends on maturity of the technology, cost, value-added, and definition of the requirement. Currently, only an UNS exists. There is some Joint interest from both the Army and Air Force (Force Protection Battle Lab).

**Description:** System is composed of sensors, weapon and vehicle. It has combined counter-sniper technology and an automate fire control system that has a *man-in-the-loop*. Sensors determine location of shooter and slew automatically to that position. Marine then determines if he should return fire. System is being developed for HMMWV variants, armored vehicles, and MV-22 transportable vehicles. This initiative is a possible technology insertion in support of the Sniper Detection System UNS. The intent is to develop a technologically mature capability set (system prototype) that can be used in extensive operational assessment in order to refine Mission Needs and ultimately fuel the requirements process. Moreover, the prototype will useful to MCSC in the event that a Program of Record is established. (Note: the APM for Transportation is interested in placing the sensor package itself on various vehicle platforms. If this is accomplished, it would constitute technology insertion to existing Program of Record.)

**Deliverable Product(s):** Assessment report of Advanced Prototype Unit mounted on Vehicle

### Milestones:



**Action Officer:** Major Lance McDaniel 784-3425

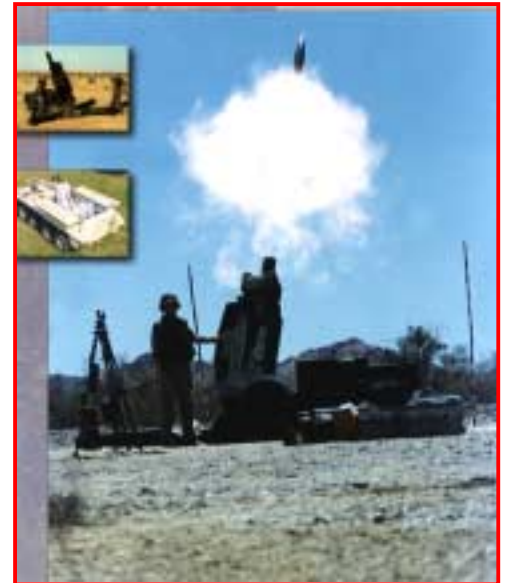
## Mobile Fire Support System (MFSS)

**Purpose:** Provide a concept demonstrator of an expeditionary fire support system that has the potential to be as mobile as the ground forces it supports as stipulated in *Advanced Expeditionary Fire Support: The System After Next*.

**Background:** A compact, 120mm rifled mortar that can be readily deployed from amphibious shipping either internally within a MV-22 or CH-53, towed by a HMMWV or LAV, or internally loaded – and fired – from a LAV. The MFSS Can be emplaced and displaced rapidly, has configuration options and on-board communications, navigation and fire control. It is a rifled, recoiling mortar that can traverse 6400 mils and is self-loading. It has internally configured digital communications and has demonstrated full sensor-to-shooter (and remote) operation. This system specifically is designed to provide a concept demonstrator for the Expeditionary Fire Support System (EFSS) MNS.

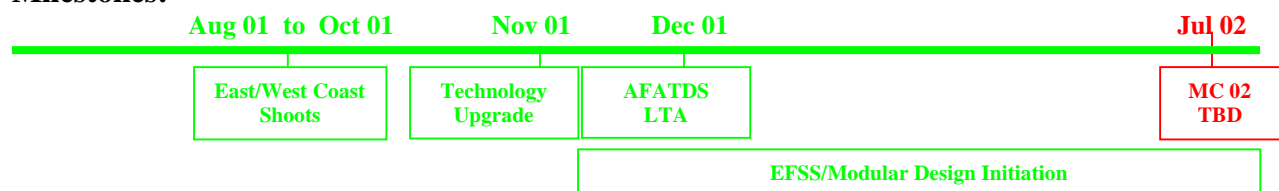
**Description:**

- 120mm rifled mortar caliber, also capable of firing 120mm smoothbore ammunition
- 8,200m range, 13,000m with rocket-assisted ammunition
- Weight 6,500 lbs (objective 5,300 lbs)
- 10 rounds/min rate of fire for 2 minutes, 4 rounds/min sustained
- Capable of internal stowage in MV-22 Osprey
- Fully automated fire control, loading, and aiming: rapid response/increased precision



Proposed technology improvements include ballistic kernel refinement, digital input of meteorological data, incorporation of the M-94 Chronograph for muzzle velocity variances, and AFTADS-98 connectivity. EFSS/Modular design process will incorporate the lessons learned in the MFSS experimentation to help define EFSS requirements. Next-generation version will weigh 1,200 pounds less, traverse faster, will be towed by IFV, and fit within a LAV and AAV. PM LAV has offered an LAV for use by MCWL for modular MFSS development. Possible next stage modifications include adaptation into an advanced HOWTAR System (using a breech loading design to permit low-angle and direct fire capability), re-design and fabricate a fully functional *concept demonstrator* incorporating lessons learned from previous experimentation (e.g. wt, size, mobility, embark-ability, and tow-ability)

**Deliverable Product(s)** Assessment and recommendations for EFSS material solution

**Milestones:**

Action Officer: Mr. Rick Lindsey 784-3425

## Mortar Ballistic Computer

**Purpose:** Support MARCORSYSCOM Ground Weapons in developing a prototype Mortar Ballistic Computer.



**Background.** At this time, Marine infantry mortar platoons have the M-19/M-16 manual plotting boards to compute firing data. An existing Mortar Ballistic Computer (MBC) ORD specifies the requirement for computerized computation for Marine mortar platoons.

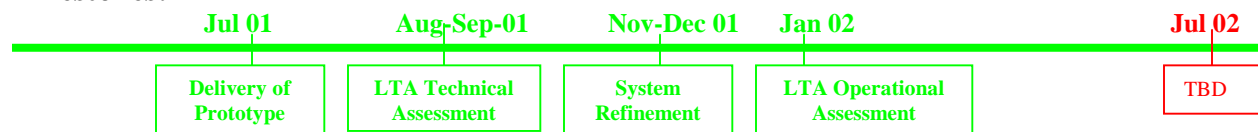
### Description:

- Provides lightweight, compact fire control for 81mm and 60mm mortars to replace M-19 Plotting Boards.
- Contains simple, easy to use fire computation program
- Contains firing data for all Marine Corps 60mm and 81mm mortar cartridges
- Compatible with AFATDS/FSTDs fire support coordination systems (Objective System)
- Uses commercial batteries
- Communicate over SINCGARS tactical radios (Objective system)

This project will involve a series of LTAs that will assess and subsequently refine the software and hardware of MBC. Initial LTAs will be conducted with operational units to refine needs. Follow-on efforts will involve longer-term assessment with operational units in the conduct of their normal training. (Concept demonstrators used by operational units for live-fire.) The end state for MBC is a transition to MCSC MBC Program of Record (POM 03). This is a very low risk project as it uses COTS hardware and leverages off of an early software prototype. Software is owned outright (APM Fire Support) which is a requirement for transition as a technology insertion into an acquisition Program of Record.

**Deliverable Product(s)** Six COTS-based Mortar Ballistic Computer concept demonstrators and an assessment report following operational evaluation.

### Milestones:



Action Officer: Major Lance McDaniel 784-3425

## Night Integrated Training Environment (NITE Lab)

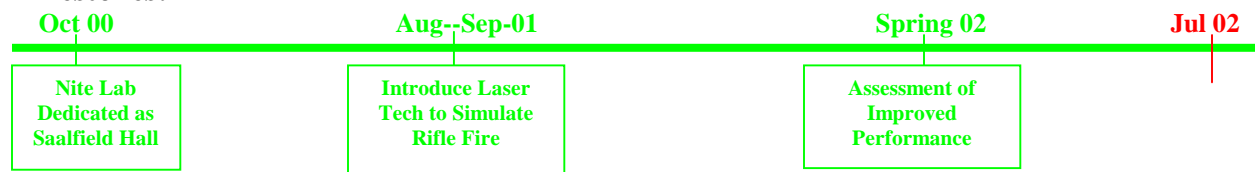
**Purpose:** Provide a prototype night fighting training venue as well as a multi-environmental laboratory for evaluating night vision devices.

**Background:** The inspiration for the NITE Lab was a similar facility located at the Infantry School at Fort Benning, GA. During FY00 the Commandant of the Marine Corps directed the development and construction of the NITE Lab.

**Description:** The NITE Lab is an operating indoor, year-round, multi-environmental training facility for small tactical units (fire team size). Located at Marine Corps Base Quantico's Camp Barrett, the home of The Basic School the facility provides 24/7, 365 days-a-year night training in individual combat skills and fire team coordination skills. The NITE Lab training begins with familiarizing Marines with night vision goggles, and develops their skills, and therefore confidence, in operating at night in various environments as a fire team while using night vision devices. Additionally, the lighting technology installed in the NITE Lab accurately replicates ambient light from the moon and stars, thus making the Lab an ideal test and evaluation facility to conduct Limited Technical Assessments of night vision optics and equipment. The end state is to determine the worth of such a facility and cost effectiveness of building like training facilities at Camp Lejeune, NC, Camp Pendleton, CA, and Okinawa, Japan. Environments include forest, jungle, desert, urban exterior with subterranean features and urban interior.



**Deliverable Product(s):** One operational prototype NITE Lab able to collect data that documents the degree of improved skill the individual Marine at the fire team level gains from the training in a NITE Lab

**Milestones:**

Action Officer: Major Bryan McKinney 784-3208

## Precision Target Acquisition, Mobile (PTAM)

**Purpose:** Support MARCORSYSCOM Ground Weapons Program Manager in the development of emerging technologies to enable indirect fires observers to use a mobile platform to simultaneously attack targets using close air support, naval surface fires, and ground fires.

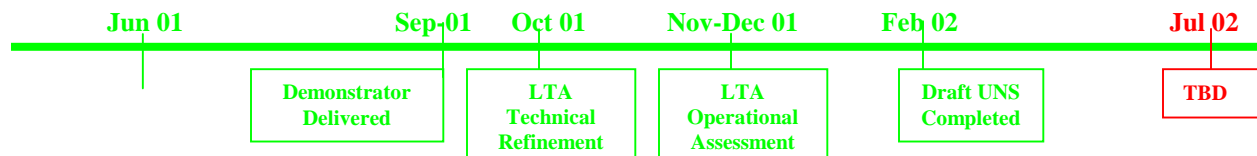
**Background:** Ground forces need a means to provide reliably accurate target location information in digital format to supporting arms agencies in order to capitalize on the precision munitions that are becoming the backbone of fire support systems. This is particularly true for mounted forces that must be capable of rapidly obtaining target location and directing fires before they become targeted themselves. This system provides precision targeting capability on a mobile platform -- such as the Interim Fast Attack Vehicle (IFAV) -- but applicable to many other vehicle platforms. This effort assists the development of a demonstrable technology capable of meeting the requirements of the Target Location, Designation, and Handoff System (TLDHS) ORD with technology developed to adapt to a mobile platform. This capability was noted in the Artillery OAG *Priority for Technology Development list, January 2001*. The system will rely on other systems such as ACASS and UCATS to feed candidate technology to this program.



**Description:** The system uses a derivation of the UCATS system that employs an inertial navigation gyro for greater precision. It is compatible with AFATDS/FSTDs fire support coordination systems and with ATHS II-equipped tactical aircraft. Experimentation will consist of a series of limited technical assessments of a concept demonstrator to include live fire by operating forces. Transition will occur in several ways. Anticipate drafting an UNS following the assessment process. Technology transition can occur based on joint decision by MARCORSYSCOM and the Combat Developer. This effort directly addresses TLDHS ORD for vehicle-based system.

**Deliverable Product(s):** PTAM Prototype transitioned to MARCORSYSCOM to support variant of TLDHS for mounted forces and completion of UNS for submission into the Combat Development System.

### Milestones:



Action Officer: Major Lance McDaniel 784-3208

## Reconnaissance, Surveillance, Targeting Acquisition (Project RSTA)

**Purpose:** Develop a reconnaissance, surveillance and target acquisition network that supports the warfighter.

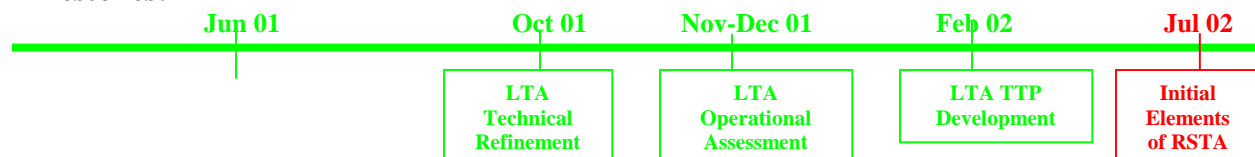
**Background:** Project RSTA is the umbrella project that integrates the development of a sensor grid and its various forms of sensor components into a coherent tactically relevant system. The sensor grid is composed of all available sensors in the battlespace – human, automated sensors, and unmanned ground and aerial vehicles. The resulting information about the battlespace will be translated into knowledge that leads to situation awareness and improved decision-making. The centerpiece of the system for the Lab is the means to automate the results of the plethora of tactical sensor feeds into an intelligent-agent driven, collaborative tool that will assist the infantry battalion-level intelligence officer to provide tactically relevant decision support recommendations to the commander.



**Description:** The RSTA Grid is intended to be a tactical, line-of-sight system that functions from the bottom (the tactical unit or individual sensor) up to the tactical user. Where possible it is intended to use current tactical communications waveforms. Due to the physics of low power, line-of-sight communications, the system is necessarily network-centric with some feeds flowing to points on the grid – such as a platoon commander or company commander from a Dragon Eye UAV – and then information is transmitted on to other stations on the Grid such as the Battalion COC. The basic philosophy is that tactical information needs to flow to the individual or unit leader who most needs the information – usually the closest to the sensing – and then on to the rest of the tactical grid. Ultimately, the tactical RSTA grid will also be compatible with other RSTA collection systems – to include the Navy Expeditionary Sensor Grid – and be able to adapt a variety of communication pathways through the use of standard signal protocols. An intelligent agent based, Battlefield Visualization Tool (BVT) will be used to support the intelligence officer to plan for the employment, employ, and use the results of the RSTA sensors.

**Deliverable Products:** By July 2002, initial elements of the Sensor Grid will be able to conduct proof of concept level experimentation during the Millennium Challenge 02 Joint Experiment.

### Milestones:



Action Officer: Major Gregory Heines 784-0614

## Tactical Warrior

**Purpose.** To assess the utility of adding additional tactical capabilities and refining the organization of the future infantry platoon in order to capitalize on emerging information technology and the TTPs developed during *Hunter Warrior*, *Urban Warrior*, and *Project Metropolis* across all environments and mission areas

**Background:** Tactical Warrior is a two-year effort intended to explore expanded tactical capabilities in the infantry platoon and company through changes in organization and the exploitation of changes in available training and technology. Experimentation by the Lab has identified three additional capabilities for potential inclusion in the infantry platoon:

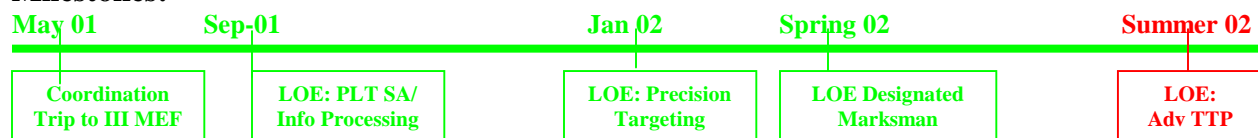


- Information/situational awareness
- Precision targeting of supporting fires
- Designated marksman

**Description:** Experimentation to be conducted in partnership with III Marine Expeditionary Force will include a series of experiments at the platoon and company. Most experimentation will be conducted at the platoon level, with limited experimentation at the company level (with a small battalion staff cell) to determine the effectiveness of the additional capabilities at each level. Each experiment will take approximately one month. Evaluations will be made of each capability on three types of terrain: urban, jungle/wooded, open. Experiments will be controlled force-on-force. For each terrain, a base line (current capability) experiment will be conducted both day and night, followed by the enhanced capability experiment. Each type of terrain will require one week for experimentation. The week prior to commencing experimentation will be devoted to unit training in new concepts and/or new equipment training. Each experiment will require designated aggressors who will represent a Chechen style (i.e., asymmetric), adaptable enemy force.

**Deliverable Product(s):** An assessment report at the conclusion of each phase of experimentation will be briefed to the GCE board with recommendations for DOTES implementation as appropriate.

### Milestones:



Action Officer: Mr. Randy Gangle 784-3237



## Unattended Ground Sensors

**Purpose:** To identify potential of Unattended Ground Sensor (UGS) technologies to expand the situational awareness within the infantry battalion.

**Background:** Marine tactical/battalion and lower units do not have organic UGS. The Marine Corps current UGS Program of Record (POR), Tactical Remote Sensor

System (TRSS) is a suite of hand-emplaced and air-delivered unattended sensors, ground and airborne relays, and sensor monitoring stations organic to the Marine Expeditionary Force Intelligence Battalion. These sensors are used by the Intelligence Battalion Ground Sensor Platoon (GSP) to expand surveillance within the MEF's battlespace.

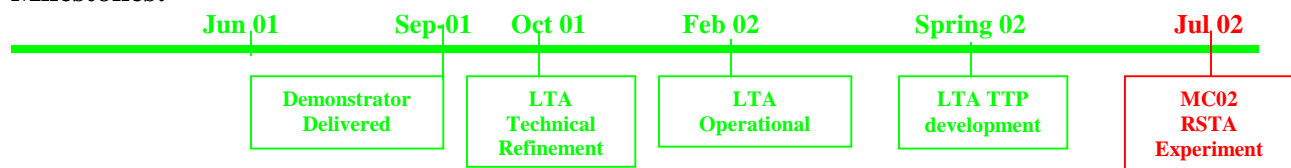
**Description:** This effort is designed to explore the potential for such UGS to provided or enhance the following tactical capability needs within our company and battalion units:

- Expanding situational awareness beyond the capability of direct human observation
- Providing force protection to Marines conducting RSTA missions
- Expanding organic Company and Battalion-level RSTA access to areas inaccessible to currently available sensors and human assets.
- Reducing manpower requirements
- Increasing stealth in RSTA activities
- Providing real-time information feedback

Additionally, the enhanced sensors will feature innovative ballistic and hand deployment means, development of low power imaging systems, miniature sensor hardware designs, collaborative, coherent and intelligence signal processing across a sensor network, and efficient software algorithms for detection, tracking, classification, and sensor planning, simulation and organization applications. Senor types will include seismic, IR, magnetic, thermal, imaging and chemical.). The enhanced capability will compliment TRSS with a more responsive, organic family of sensors to enhance an infantry battalion's capability to view it's assigned areas of influence. MCWL RSTA personnel are working closely with Marine Corps System Command TRSS representatives to ensure that MCWL efforts are complimentary and leverage common technology and capability. There is no intent to establish a new POR.

**Deliverable Product(s):** Initial concept demonstrators and TTPs of easily deliverable, camouflaged, undetectable IR, magnetic, thermal, and imaging sensors compatible to the RSTA Tactical Sensor Grid.

### Milestones:



Action Officer: Sergeant Long 784-0614

## Universal Combined Arms Targeting System (UCATS)

**Purpose:** Provide a smaller, lighter, more reliable version of the FO/FAC for target acquisition for air, naval fires and artillery/mortar systems.

**Background.** During *Hunter Warrior* the Lab used the initial prototype FO/FAC capability to digitally pass close air support missions from the forward air controller both to the DASC and pilot in specially equipped aircraft. The use of the system has the potential to dramatically improve the responsiveness of both close air support and other supporting arms for ground forces in contact. This effort is in support of MARCORSYSCOM's Target Location, Designation, and Handoff System (TLDHS) Program Manager.

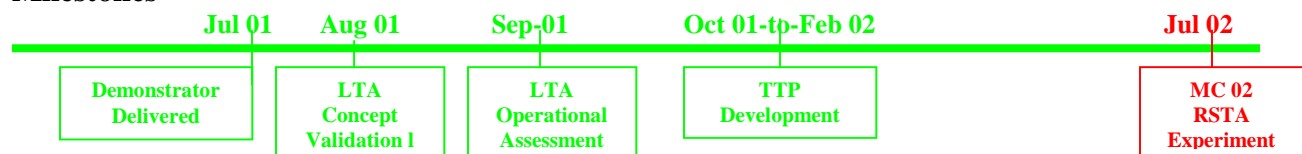


**Description:** A system composed of a lightweight, ruggedized hand-held computer (RHC) with an internal GPS device, an eye-safe laser range finder and voice and digital communications capability. The system is intended to be a ruggedized handheld computer with imbedded GPS, laser range finder, and MBITR radio with the ability to process a lased target into an accurate target location, then use that target location as a target for a fire mission for ground, air, and naval surface fires simultaneously or separately and then pass that fire mission digitally to the firing agencies/aircraft. UCATS will be very lightweight and compact, with a complete system weight of 15 pounds. A simplified menuing process ensures faster response/ training. A scalable color map display with GPS centering for advanced situational awareness/mission execution/safety planning is a key feature.

UCATS will be assessed in a series of LTAs first for its basic system functionality and then for its capability and applicability to potentially address warfighting shortfalls. If successful, it is expected to be a lead candidate for technology insertions into the TLDHS program as well as identifying the additional benefits in increased responsiveness and lighter weight. UCATS leverages the ACASS program to reduce risk, costs, and development time. System development will include significant input from the user through the use of the Forward Observer Review Panel (FORP) consisting of 0861 SNCOs from I and II MEFs and the Lab.

**Deliverable Product(s):** Technologically mature capability set transitioned to MARCORSYSCOM Program Manager as a potential technology insertion into a TLDHS Program of Record and an updated UNS to refine the current requirement to reflect the lessons learned from this concept-based experimentation process.

### Milestones



Action Officer: Major Lance McDaniel 784-3208

## Urban Range Instrumentation (Integrated GPS Radio System/Data Collection System)

**Purpose:** To develop a deployable instrumentation system to provide weapons effects adjudication, position location information, and after action report capabilities.

**Background:** Commencing during the *Hunter Warrior* experiments, the Lab has been faced with the need for more responsive and accurate position location information on tactical units for both conducting the experiment and reconstruction during after experiment analysis. Since the Lab fundamentally rejected the concept of fixed instrumented facilities – and their resulting dramatically increased Heisenburg effect – in favor of experiments in off-base urban areas and in a variety of environments, a mobile wearable system was required. Such a system has emerged within the Lab with the ability to track both individuals and unit locations using wearable GPS and radio transmitters. This system has applications both for experimentation and training. Accordingly, the Lab has collaborated with various training systems under the cognizance of both Training and Education Command and MARCORSYSCOM.



**Description:** MCWL will document the use of the current system into usable TTP and lessons learned during routine data collection during experiments through MC02. System characteristics are:

- Man-portable tracking system (300 field units, 2 ground base stations, 1 airborne relay, 1000 inside building instrumentation sets)
  - Personal & vehicle PLI data can be accumulated
  - IMMACCS data collection system
  - Critical to experimental data collection
  - Interfaces with MILES 2000
  - Used for both experiment control and to conduct post experiment data analysis
  - Used since Hunter Warrior
- Deliverable Product(s):** Deployable range system complete with TTP and lessons learned for employing the system either to collect experimentation data or as a After Action Review for training exercises.

### Milestones:



**Action Officers:** Lieutenant Colonel Colin Beadon, RM 784-3785 and Dr. Helen Karppi 784- 3208

## Urban Combined Arms Exercise (UCAX)

**Purpose:** To provide combined-arms, reinforced battalion training event in an urban environment that will prepare the units to operate in the urban environment effectively without unnecessary casualties.

**Background.** Beginning in *Urban Warrior* and continuing through *Project Metropolis*, the Lab has developed a series of TTPs that have proven to successfully reduce the rates of casualties incurred by units that have undergone training in their employment. These TTPs not only include new organizational principles for combined arms team operations but also a comprehensive basic training skills package for the individual Marine. Key to this training is the use of a combination of Sim-Munition and MILES 2000 instrumented feedback when casualties due to direct fire weapons are incurred. In addition, the Lab has employed simulations such as the “no-drop bomb scoring system” to provide responsive assessments of simulated supporting arms effects within experiments.



**Description:** After observing the improvement in the effectiveness of units that have undergone the urban training skills training using a force-on-force model, the Lab has developed a prototype force-on-force, urban, combined-arms exercise as an evaluation tool for assessing the effectiveness of unit urban tactical capability. This prototype UCAX incorporates a range of situations – based on the concept of the three block war – and places a premium on the unit commander and his staff in conducting urban IPB and aggressive, adaptive tactical skills. The UCAX is envisioned as a 96-100 hour force on force operation in urban environment. It is a free play, umpired, force-on-force evaluation of a unit’s capabilities to conduct typical missions within all three *blocks* of urban warfare.

**Deliverable Product(s):** Tailored Urban TTPs, BUST POI, Proposed changes to Individual Training Standards.

## Milestones:



Action Officer: Lieutenant Colonel Colin Beadon, RM 784-3785

## *Combat Service Support Element Initiatives*

Guided Parafoil Aerial Delivery System (GPADS)  
High Speed Vessel (HSV)  
SEAWAY/LOGGY  
Small Unit Logistics ACTD  
Tactical Medical Coordination System (TacMeds)

IV-CSSE-1  
IV-CSSE-2  
IV-CSSE-3  
IV-CSSE-4  
IV-CSSE-5

## Guided Parafoil Aerial Delivery System (GPADS)



**Purpose:** To assess the operational utility of the precision, tactical delivery of material and equipment within a constrained environment over a dispersed battlefield utilizing steerable parafoils.

**Background:** This effort is in support of Improved Cargo Aerial Delivery System Mission Need Statement (ICADS MNS) of Aug 98 and the CSSE: 2001 Logistics Campaign Plan (Objectives 1.3 and 1.3.5) to determine if a commercial system can provide long-range, just-in-time logistic resupply to small units and personnel over a dispersed battlespace.

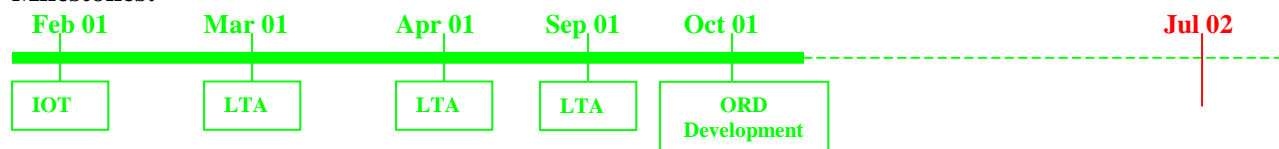
GPADS technology represents a potential solution to the logistics deficiency created in an Operational Maneuver From The Sea (OMFTS)/Ship To Objective Maneuver (STOM) environment while increasing the safety of delivery aircraft and aircrew. The Lab first experimented with it during *Hunter Warrior* along with powered parafoils and rigid wing technologies. This is a Joint endeavor.

**Description:** Cargo delivery system capable of transporting up to 1,100 pounds of equipment. Composed of a static-line parachute and platform that can be guided by global positioning system (GPS), beacon or manual guidance. Currently, has a 20-kilometer standoff distance and can be deployed from as high as 25,000 feet above sea level (ASL).

**Concept of Experimentation:** Experimentation will provide opportunities to validate manufacturer claims as to the specific technology, assess and determine its military utility, and assist in its transition into the MARCORSYSCOM fielding process through Program Manager, Combat Support Logistics Equipment. This will be accomplished through data collection from a series of LTAs and refinement of the Improved Cargo Aerial Delivery System Mission Need Statement (ICADS MNS) into an Operational Requirements Document (ORD). LTAs will conclude at the end of the current fiscal year as specific COMNAVAIRSYSCOM interim flight clearances and training areas large enough to support complete system assessment become available during the latter half of FY01.

**Deliverable(s):** (1) Refined ICADS MNS and ORD creation to clearly focus technology development and (2) recommendations on current technology for transition. .

### Milestones:



Action Officer: Captain James Stone (703) 784-1088

## High Speed Vessel (HSV)

**Purpose:** The objective of the High Speed Vessel (HSV) initiative is to evaluate the military utility of HSV's in support of USMC operations in an EMW environment.

**Background:** Currently the HSV is a joint initiative exploring the concepts and capabilities



associated with commercially available, advanced hull, propulsion, and communications technology. The Marine Corps is considering partnership with the Army and the Navy to leverage state-of-the-art HSV technology. The Army's vision involves high-speed sealift from CONUS. The USMC vision is to use a "sea-base" from over-the-horizon to effect force closure and facilitate reconstitution and redeployment. Within the Joint HSV concept, the USMC primary requirement is for a vessel to transit

between an Intermediate Staging Base (ISB) to the MPF (F) sea-base and back.

PP&O (POE) is the USMC representative to the HSS Working Group (HSSWG) sponsored by the Chief of Naval Operations (CNO). Representatives to the HSSWG include, Army (DC/S Logistics), Navy (Expeditionary Warfare Office and SOCOM).

During the period of the lease, the Marine Corps will experiment with the HSV by conducting an "in stream" equipment transfer during an MPF operation and the subsequent high-speed delivery of select equipment to Blount Island Command (BIC in Florida. The Marine Corps will also experiment with the HSV during the upcoming joint experiment, MC '02.

### Description: HSV will provide the following capabilities:

- Enhanced MAGTF agility, operational reach, and tactical flexibility,
- Enhanced MAGTF ability to operate, sustain, withdraw, regenerate & redeploy forces,
- Increased operational tempo in littoral operations,
- Transportation of MAGTF's from expeditionary bases/ISBs in support of early entry •,
- Increased throughput of supplies by access to austere, degraded, or minor ports,
- Enhanced MPF (Future) concept of Arrival and Assembly of forces at sea (and at the ISB)
- Movement of CSS functions to support Naval Forces (CLF linkage)

**\*Note:** The roles and missions of HSV should be kept in proper perspective. The HSV is **NOT**: a Naval Amphib (i.e. "fast LST"), high-speed "strategic sealift" to project forces from CONUS, or a high-speed lighterage

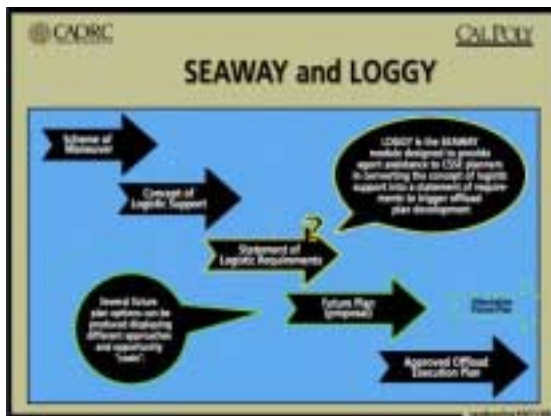
**Deliverable Product:** A vessel that provides the MAGTF a high-speed, intra-theater mobility asset.

### Milestones:



Action Officer: Captain James Stone (703) 784-1088

## SEAWAY/LOGGY



**Purpose:** Provide an adaptive course of action assessment tool for translating courses of action into statements of logistics requirements and Combat Service Support offload plans for use in wargaming and concept assessment.

**Background:** To transition from *seminar wargaming* to computer assisted *analytic wargaming* requires tools to bring precision to discussion of future concepts. This specifically includes feasibility of seabased OMFTS/STOM concepts in order to identify the assets and

in what quantities would be required in what operational frames. And there is a second requirement: to provide the adaptive C2 with which to execute the logistic planning, monitoring, and continuous in-stride re-planning vital to successfully executing sea based sustainment. The software tools in SEAWAY/LOGGY are designed to provide both of these capabilities.

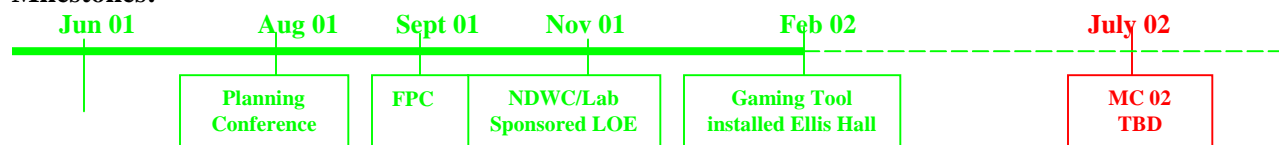
**Description:** SEAWAY/LOGGY is a distributed adaptive logistic C2 system, which employs intelligent agent technology to manipulate incoming information and data for logistic planning and execution. The software agents in SEAWAY act as shadow staffs assisting the sea base commander as well as the joint task force and/or MAGTF commander to develop coordinate and approve logistic plans during the contingency. But, unlike most current systems, the creation of an offload plan to support the JTF from the sea base is only the first step. As information is received highlighting changes in the operational, the weather, or the inventory picture, SEAWAY continuously modifies the plan and creates follow on sequels for staff review.

SEAWAY/LOGGY can be artificially stimulated with situational inputs in order to produce alerts, warnings, implications, and option comparisons. Equipped with a gaming interface, SEAWAY offers an integrated synthetic maritime expeditionary environment. It is a near real time operational framework in which weather, the operational picture, inventory, and forces can all be manipulated individually or collectively at the same time. It is also an environment in which virtual systems such as a new ship or helicopter could be easily introduced to assess impact and value.

**Concept of Experimentation:** The SEAWAY prototype is being prepared for employment in an NWDC-Lab (Wargaming) co-sponsored limited objective experiment scheduled for 26-30 November 2001 at NAB Coronado. Designed as a phased future naval expeditionary operation, the LOE will be executed in much the same fashion as a CPX, relying on a Control Cell to focus the game and to continuously alter the conditions and factors surrounding execution of logistic operations. SEAWAY will respond with near real time alerts, warnings, implications, and recommendations. NWDC and the Lab will furnish analytical and observer cells while Third Fleet and I MEF will provide player cells. PHIBGRU 3 will host the LOE.

**Deliverable Product:** A working wargaming COA assessment tool for future concepts and capabilities.

### Milestones:



Major John Sumner (703) 784-3276

## SMALL UNIT LOGISTICS ADVANCED TECHNOLOGY DEMONSTRATION (SUL ACTD)



**Purpose:** To demonstrate a “proof-of-concept” to improve logistics command and coordination by improving Combat Service Support (CSS) responsiveness in the areas of supply, distribution, and maintenance via the ability to conduct anticipatory logistics.

**Background:** The SUL initiative is a FY99, Deputy, Under Secretary of Defense (Advanced Concepts & Systems)(DUSD, [AC&S]) approved ACTD that is an outgrowth of earlier experimentation efforts during Hunter Warrior and through the experiences of CSS Enterprise.

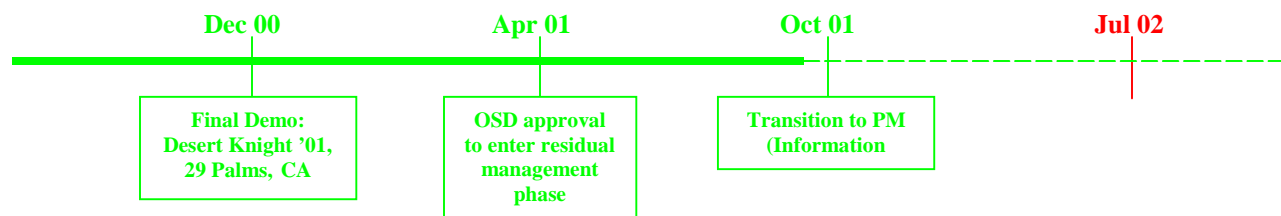
CINCUSPACOM is the operational sponsor with the 1<sup>st</sup> FSSG providing the operational manager. The Marine Corps Systems Command (MCSC) is the executive agent providing the technical manager. The Office of Naval Research (ONR), MCSC, Office of the Secretary of Defense (OSD), and the MCWL jointly fund the SUL ACTD.

**Description:** The SUL system is an interoperable tactical level logistics command and control software system utilizing an open systems architecture. The system provides the flexibility offered by “middleware” to allow continued access to data and information resident in other applications, databases and systems. The system will provide data in a coherent manner to the user even though it may have originated from physically separated heterogeneous databases. The system shall incorporate point and click technologies with the appropriate interface, query and mediation programming and be operable over existing tactical, operational and strategic communications networks.

**Concept of Experimentation:** MCWL provides financial resources, facilities, demonstration support, and experimental venues in order to show development.

**Deliverable Product:** Software based, decision support tools coupled to a web-based enabler providing access to and integration of both tactical and logistics information.

### Milestones:



Action Officer: Captain James Stone (703) 784-1088

## Tactical Medical Coordination System (TacMedCS)

**Purpose:** Support MARCORSYSCOM and the Navy Medical Department to develop a prototype system to enhance casualty evacuation via an *individual casualty locator* and provide an electronic, redundant patient treatment record retrievable from external locations.

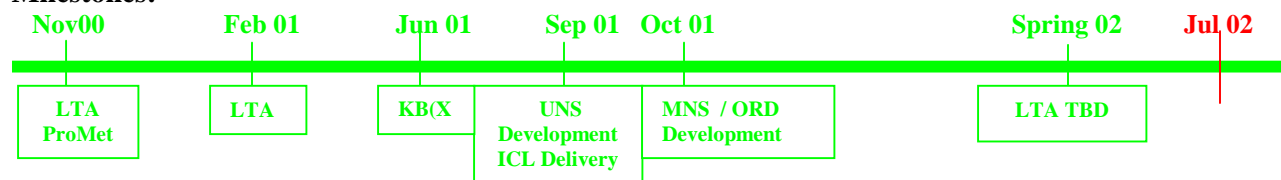
**Background:** No current system exists to ease locating casualties for evacuation and to provide treatment record redundancy. The relevant ORD is 95334D-E07 and the JV2010 *En route Care Seminar* indicated that that this capability was needed to support emerging concepts. TacMedCS is like *FEDEX for casualties*. The concept is based on a radio frequency tag worn by individual that acts as a digital treatment record. This system differs from SMARTCARD and other alternative approaches to digital medical information. TacMedCS is appealing because it is an RF based system, which doesn't require contact with the device to be able to read and write data. There is no need to remove clothing or protective gear. The tag has been tested through MOPP gear, Kevlar, body armor, and various other forms of military clothing. The tag is totally passive. It transmits nothing until it is hit with RF from the interrogator.



**Description:** The corpsman scans a casualty with a hand held device. The device uploads the embedded information on the RF Tag. (Later models will note the GPS location.) The corpsman can make some basic entries about the injury and treatment. That information would then be recorded on the tag and the hand held hard drive. If communications are available, that information can be entered into the tactical information grid. If communications aren't available, the device records the information for transmission at a later time. The system uses a geo-referenced map display known as *Viewport*. The map display is backed up with a database. Since the data and the map are geo-referenced the casualty is represented by a dot on a map coded to represent the triage code. If the dot is interrogated the system provides the details of the casualty. *Viewport* also provides the operator the ability to place icons around the theater to represent the physical location of assets. *Viewport* can run on a standard laptop and is compatible to DARPA's *Encompass* package but can function independently. The Lab currently has access to two working brief case-size prototype systems and with the possibility to acquire one next generation, reduced size system with the electronics reduced to fit into a fanny pack. This fanny pack is plugged into a wearable computer. Subsequent prototypes will be reduced even more with an ultimate goal of a device the size of a palm pilot or smaller.

**Deliverable Products:** Two TacMedCS systems for use in field operational assessments and experiments leading to a proof of concept and a written assessment and proposed TTPs.

### Milestones:



**Action Officer:** Captain (USN) Chris L Schuyler. Phone: 703 784-3208

## EXPLOITATION OF EXPERIMENTATION

### Background

There is no point in experimenting if the Lab does not impact decisions about future capabilities. Accordingly, developing the products that articulate the results of experimentation – and ensuring that those products are distributed to the right audience – is as important as conducting the experiment in the first place.

**If the paperwork is not done and delivered to the right decision maker to effect change in warfighting capability, there is no point in having conducted the experiment in the first place.**

Experimentation successes must have a reasonable chance of leading to a recommendation that can be incorporated into future capabilities. Accordingly, in most cases experiments are performed in partnership with a Warfighting Advocate or an agency within the Combat Development System such as Training and Education Command or MARCORSYSCOM intended to lead directly into an implementable recommendation.

**The Job's Not Over Until the Paper Work is Done and the Decision is Made.** Once the live experiment is over, the last debrief has been conducted, and the last data form has been filled out and collected, the experimentation process has only just begun. The data that have been collected undergo analysis and the results are documented and fed back to the warfighters and the combat development process to support decisions about what should become of the experimental tactics, techniques, procedures (TTPs) and technologies. This analysis and

assessment process can take months to complete.

Even after the analysis and assessment reports are prepared, institutional acceptance of the results of experimentation may require extensive follow-up efforts. Successful experimentation results in decisions.

### Exploitation

To fully leverage the results of experimentation requires a concerted effort to educate and inform various audiences. Explaining experimental failures is as important as explaining experimental successes. Failure in experiments indicates that the Lab is pushing the envelope on capabilities and that it is honest in its assessments. Identifying ideas for capabilities that do not work is important to close out programs and efforts so resources can be used in other areas that have more potential for success.

The Lab documents its results in five primary ways:

- *The Command Brief* and the *Experimentation Campaign Plan* – Prepared by Experiment Plans Division
- *Analysis Reports* – Prepared by Analysis Branch
- *Assessment Reports* – Prepared by Experiment Operations Division
- *X-Files* – Prepared by the X-File Branch
- *Products* (Draft UNS/MNS/ORDs, prototype equipment, Programs of Instruction, etc.) – Prepared by Experiment Technology Division or project teams once transitioned to Experiment Operations Division for execution.

The Lab prepares specific products to *shape the battlefield* of public opinion both within

and without the Marine Corps through an active Public Affairs program with the media, informative sessions with official visitors and by distributing products like a web site, brochures, CDs, and briefs that can be used to keep Marines informed.

Fundamentally, the responsibility to tell the experimentation story is shared by all members of the Lab. Each member should be prepared to distribute Lab products and discuss the Lab's ongoing experimentation efforts.

## X-Files

*X-Files* are pocket-sized, pamphlets containing useful, clear information that can be quickly read. They convey a synthesis of learning from experiments on MOUT tactics, techniques, and procedures and also some enabling technologies that can help Marines fight and win battles on urbanized terrain.

They represent an evolving body of knowledge that will be refined and inserted into the Marine Corps Combat Development System when experiments are concluded.

The X-Files use post-training analysis and feedback from Marines. They are not doctrine, nor are they Standing Operating Procedures (SOPs). They are widely distributed to the Marine Corps to include the Operating Forces and selected Marine Corps Schools. They are also available for download from the Lab's web site at: [www.mcwl.quantico.usmc.mil](http://www.mcwl.quantico.usmc.mil).

## X-Files Available on the Web Site:

[MCWL X-File 3-35.1](#) -- Urban Attack

[MCWL X-File 3-35.2](#) -- Combat Squad  
Leader Decision Making

[MCWL X-File 3-35.5](#) -- Urban Defense

[MCWL X-File 3-35.6](#) -- Urban Patrolling

[MCWL X-File 3-35.7](#) -- Security Operations

[MCWL X-File 3-35.8](#) -- Combined Arms

[MCWL X-File 3-35.11](#) -- Humanitarian Assistance  
and Disaster Relief Assessments (**Not Restricted**)

[MCWL X-File 3-35.12](#) -- Urban Sustainability

[MCWL X-File 3-35.13](#) -- Tactical Instrumentation

[MCWL X-File 3-15.31](#) -- Designated Marksman

[MCWL X-File 3-35.35](#) -- Intra Squad Radio

[MCWL X-File 3-33.63](#) -- Humanitarian Assistance  
and Disaster Relief Operations (**Not Restricted**)

[MCWL X-File 3-35.21](#) -- Cliff Assault

[MCWL X-File 3-35.37](#) -- Squad and Platoon  
Combined-Arm Teams in MOUT

[MCWL X-File 3-35.11](#) -- Small Unit Support  
Vehicle (SUSV)

[MCWL X-File 5-12X](#) -- Experimentation  
Procedures